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THE BULLETIN
OF
The Institution of Engineers (India)

SECRETARY & EDITOR: B. SESHADRI, B.Sc., A.I.I.Sc., D.I.C., M.Sc.(Eng.), M.I.E.

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ELECTION TO THE COUNCIL 1962-63
FROM THE DIVISIONS

The Council at its Meeting No. 426 dated 12th August, 1962, at Calcutta adopted the following resolution :

Resolution 22.

'*Resolved* that the new Bye-Laws be adopted immediately. The Council also *resolved* that the Secretary conduct elections to the new Council which would take office on the date of the next Annual General Meeting in accordance with the provisions of the new Bye-Laws. The Council also *resolved* that the present Council carry on till the next Annual General Meeting'.

In accordance with the provision of the new Bye-Laws, the Council for 1962-63 will be constituted as follows :

Bye-Law 37

The Council

'The Council consist of the President, two immediate Past-Presidents, Chairmen of the Local Centres during the period of their office, three Corporate Members from each Division who shall be elected by the Corporate Members of that Division on an all-India basis, and eighteen other Corporate Members who shall be elected by the Corporate Members of the Local Centres, the number of seats allotted to each Local Centre being proportional to the strength of Corporate Members at that Local Centre. The strength of the Council shall not exceed sixty-four.

All these elections shall take place by the method of proportional representation with a single transferable vote.'

Accordingly, the allocation of seats on the Council from the Divisions will be three Corporate Members from each Division who will be elected by the Corporate Members of that Division on an all-India basis.

In persuance of this, I am directed by the President in the absence of the Secretary who is abroad, to issue Nomination Forms for election to the Council from the Divisions.

The Nomination Form duly completed should be returned to me by name, so as to reach this office by **4.00 p.m. on or before October 5, 1962.**

14th September, 1962
Calcutta

S. Sarwal
Deputy Secretary

General Information

1. A Corporate Member will be entitled to nominate 3 Corporate Members from within the Division to which he is attached according to his/her classification, *i.e.*, a Corporate Member classified under Civil Engineering Division will be eligible to nominate Corporate Members classified under Civil Engineering Division only.

2. Where a Corporate Member is attached to two or more Divisions, he/she will be eligible to nominate or be nominated to either or all the Division/s to which he/she is attached according to his/her classification/s.

3. All Corporate Members of the Institution are attached to one or the other engineering Division/s according to their classification/s. The classified list of Corporate Members elected up to 31st August, 1961, is as published in the Year-Book 1960-61. The classification of Members elected since September 1, 1961, is as intimated in their 'letters of election'.

4. Classification/s of Corporate Members, as published in the Year-Book 1960-61, of the Institution, will *only* be accepted for determining the validity of the Nomination/s for elections to the Council for 1962-63 from the Divisions, except in the case of members elected since 1st September, 1961, whose classification/s will be as specified in their 'letters of election'.

5. Copies of the Year-Book 1960-61 and lists of Corporate Members elected on or after 1st September, 1961, with their classification/s are available in all Local Centre and Sub-Centre Libraries.

6. The Symbols used for classification/s of Corporate Members in the Year-Book 1960-61 and the 'letters of election' are as follows :

Classification symbol	Corresponds attachment to
C	Civil Engineering Division
M	Mechanical Engineering Division
E	Electrical Engineering Division
Ch	Chemical Engineering Division
MM	Mining and Metallurgy Division
ET	Electronics and Telecommunication Engineering Division

7. As no Corporate Member is classified under the General Engineering Division, no election to the General Engineering Division will be held.

8. The Revised Bye-Laws adopted by the Council are published in this *Bulletin* on pages 7 to 25.

9. Before sending the Nomination Forms, Proposers are requested to *ensure* that the consent of the Corporate Member/s nominated by them is *obtained* and indicated on the Nomination Forms by the nominee's signature in each case, or by a letter accepting the nomination/s, which should be sent with the Nomination Forms in *original*.

10. Nomination Forms containing more names than there are seats, or nomination to or by Corporate Members ineligible to nominate to a particular Division/s or Forms incomplete or incorrectly filled in any way will not be valid.

11. Before returning the Nomination Form, the Proposer, must sign in the space provided, clearly giving details of his/her grade of membership and number, with full name and address in *block letters*.

12. The Nomination Forms duly completed should be returned by name to Shri S. Sarwal, M.I.E., Deputy Secretary, The Institution of Engineers (India), 8 Gokhale Road, Calcutta 20, so as to reach **not later than 4.00 p.m. on or before October 5, 1962.**

REVISION OF BYE-LAWS

A Meeting of Corporate Members of the Institution had been held in Jaipur on Saturday, November 26, 1960, 'To consider certain alterations to the Bye-Laws which had been proposed by the Council of the Institution, and which had been recommended by the Council to the Corporate Members of the Institution at its 416th Meeting held at Calcutta on 3rd and 4th September, 1960.' The Notice of the above Meeting and the Schedule referred to in the Notice were printed in the October 1960 issue of the *Bulletin*, and the minutes of the meeting in the December 1960 issue of the *Bulletin*.

At that Meeting, the then President, Dr. K. L. Rao, had mentioned that over the previous two years, the Government of India had expressed that full unity should be achieved amongst engineers under the umbrella of a single organization, as a result of which the Government had prepared a Draft Bill called 'The National Council of Engineers' Draft Bill 1959', in which it was proposed to give equal representation to the Institution, the Institution of Telecommunication Engineers, and the Indian Institute of Chemical Engineers. He said that discussions had also proceeded simultaneously between the representatives of the three Institutions without, however, achieving any concrete results.

The President also expressed that the Council of the Institution had, in this context, been working for over a year to bring the Bye-Laws of the Institution more in conformity with the needs of the engineering profession today. In conclusion, he said that if the General Body of Corporate Members agreed with the Council's views in this matter and adopted the proposed revision of the Bye-Laws, the revised Bye-Laws would then be submitted to the Government for approval by the appropriate authority. The President while proposing certain amendments to the existing Bye-Laws as given in the Schedule annexed to the Notice of the Meeting and as passed by the Council at their meeting on September 3-4, 1960, also said that some of the clauses of the amendments as printed in the Schedule to the Notice of the Meeting were further amended, and the finally amended and revised Bye-Laws were unanimously adopted. A resolution to the effect that 'The President is authorised to make drafting corrections, remove inconsistencies and make minor changes as may be necessary, with the assistance of legal advice' was adopted unanimously.

The revised Bye-Laws which had been unanimously passed by the General Body of Corporate Members was submitted by Dr. K. L. Rao in December 1960 to the Secretary to the Government of India, Ministry of Scientific Research and Cultural Affairs, New Delhi, for approval by the appropriate authority.

The Ministry of Scientific Research and Cultural Affairs to which the revised Bye-Laws had been submitted, examined the matter in detail, and in May 1962, the Deputy Educational Adviser (T) to the Government of India wrote a letter to the Secretary of the Institution, which is reproduced below :

No. F. 21(85)/61-T4
Government of India
Ministry of Scientific Research and Cultural Affairs

New Delhi-2, the 7th May, 1962
Vaisakha, 1884(S)

From

The Deputy Educational Adviser (T) to the Government of India

To

The Secretary,
Institution of Engineers (India),
8 Gokhale Road,
Calcutta 20

Subject—Revision of Bye-Laws of the Institution of Engineers (India)

Sir,

I am directed to refer to the correspondence on the above mentioned subject resting with your letter No. BS/9/10136 dated the 25th January, 1962 and to say that the Ministry of Law concurs with the opinion expressed by the Attorney-General of India, namely, that after the passing of the Constitution of India, there is no authority in India which can take the place of the Privy Council for the purpose of granting the consent required by the Charter for amendment of the Bye-Laws of the Institution. The absence does not, however, prevent the Institution of Engineers from amending its Bye-Laws. Such amendments to the Bye-Laws, if made in accordance with its own rules, are valid and binding as if they had been approved by the Privy Council.

Yours faithfully,
(Sd.) B. Sen
Deputy Educational Adviser (Tech.)

This letter was placed before the 425th Council Meeting on May 20, 1962, at Bombay, and arising out of further discussion on this, the Council resolved that the President be requested to take steps to refer the Royal Charter to the Supreme Court for the interpretation of Clause 18 as to who now takes the position and powers of the Privy Council in India.

In accordance with this resolution, the President addressed a letter to Shroff & Co., the Institution's Solicitors in New Delhi, requesting for their advice as to the lines on which further action may be taken in the matter. In their letter dated July 19, 1962, Shroff & Co. expressed, 'We are in agreement with the opinion passed by the Ministry of Scientific Research and Cultural Affairs, Government of India, in its communication No. F. 21(85)/61-T4 dated 7th May, 1962, addressed to the Secretary of the Institution.'

The whole matter was again considered by the Council at its 426th Meeting held in Calcutta on August 12, 1962, and the Council resolved to put the revised Bye-Laws into immediate effect. The finally amended and revised Bye-Laws which were unanimously approved at the Meeting of Corporate Members of the Institution at Jaipur are printed in the following pages.

BYE-LAWS

(*Effective August 12, 1962*)

Preliminary

1. *Interpretation :* In these Bye-Laws, unless the context otherwise requires, expressions shall have the same respective meaning as in the Charter, and words importing the singular shall include the plural, masculine shall include feminine and *vice versa*, and words importing persons shall include bodies corporate.

Furthermore, unless there be something repugnant to or inconsistent with the subject or context :

(a) 'The Bye-Laws' means the Bye-Laws of the Institution for the time being in force.

(b) 'The Charter' means the Royal Charter by which the Institution is incorporated.

(c) 'Chartered Engineer' means Corporate Member of the Institution.

(d) 'The Council' means the Council of the Institution constituted under these Bye-Laws.

(e) 'Chairman of Local Centre' means the Chairman of the Committee of a Local Centre.

(f) 'Division' means one of the Divisions of the Institution.

(g) 'Division Council' means the Council of a Division of the Institution.

(h) 'Executive Committee' means the Executive Committee of the Council constituted in accordance with these Bye-Laws.

(i) 'Financial Year' means the twelve months ending the 30th day of June of every year.

(j) 'The Institution' means the Institution of Engineers (India) incorporated by the Royal Charter 1935.

(k) 'The President' means the President of the Institution.

(l) 'The Regulations' means the Regulations of the Institution for the time being in force.

(m) 'The Secretary' means the Secretary or Secretaries of the Institution as may be appointed from time to time.

(n) 'Vice-President' and/or 'Chairman' means a Vice-President of the Institution who is also a Chairman of a Division of the Institution.

2. *Headquarters of the Institution :* The Headquarters of the Institution shall be situated in Calcutta. The Headquarters can be shifted to any other place as may be decided by the two-thirds majority of Corporate Members on the Roll by postal ballot.

Local Centres

3. (a) The Council may establish Local Centres of the Institution at different places in India with defined geographical boundaries and entrust to such Local Centres such

functions as the Council may prescribe from time to time depending upon the strength of the membership in the various Divisions at the Local Centres concerned.

(b) The Council may entrust certain functions collectively to two or more Local Centres as it may deem fit in the interests of the Institution.

(c) The Council may establish Sub-Centres within the geographical boundaries of a Local Centre with such functions as the Council may prescribe from time to time.

(d) The Council shall frame Regulations and may amend them from time to time in regard to the formation of Local Centres and Sub-Centres, and for the management of the Local Centres and Sub-Centres singly or collectively for such functions as the Council may prescribe from time to time.

Divisions

4. (a) Unless and until the Council shall otherwise direct, for the attainment of the objects of the Institution in the main branches of engineering, the Institution shall have the following Divisions designated as under :

1. Civil Engineering Division
2. Mechanical Engineering Division
3. Electrical Engineering Division
4. Mining and Metallurgy Division
5. Electronics and Telecommunication Engineering Division
6. Chemical Engineering Division
7. General Engineering Division

The General Engineering Division shall include all branches of engineering not covered by the other Divisions.

(b) The Council may form new Divisions when the number of Corporate Members in a main branch of engineering is not less than 500. This requirement will not however apply to the Divisions already named above.

Members and Attached Persons

5. There shall be the following classes of members of the Institution :

(a) Members, Honoris Causa
    Honorary Members
    Honorary Life Members

(b) Corporate Members (Chartered Engineers)
    Members
    Associate Members

(c) Non-Corporate Members
    Companions
    Graduates

The respective classes of members shall be elected as prescribed in the Bye-Laws and the Regulations.

6. There shall be the following classes of attached persons and bodies in the Institution :

(a) Students

(b) Subscribers

(c) Technicians

Students, Subscribers and Technicians shall be attached to the Institution as prescribed in the Bye-Laws and the Regulations.

7. (a) Existing Corporate Members as on the date of coming into effect of these Bye-Laws shall be attached to one or more Divisions as per their choice subject to requisite qualifications and experience, and the decision of the Council in this behalf shall be final.

(b) Candidates for election as Corporate Members after the coming into force of these Bye-Laws shall on election be attached to one or more Divisions according to their qualifications and experience, and the decision of the Council in this behalf shall be final.

8. Honorary Members and Honorary Life Members shall be Honorary Members and Honorary Life Members of the Institution in all its Divisions.

9. Companions, Graduates, Students and Subscribers shall not be attached according to Divisions.

10. Technicians may be classified according to their trades.

11. *Honorary Members* : The President of the Indian Republic, the Prime Minister of India, and Governors of States or equivalent Heads of States shall be declared elected as Honorary Members for the tenure of their office by the President on behalf of the Council after obtaining their consent. The Council shall frame rules in regard to the manner of bestowing the Honorary Membership on these high dignitaries.

12. *Honorary Life Members* : The Council may bestow the honour of Honorary Life Membership on such eminent engineers in India and abroad as have highly distinguished themselves in the engineering profession. The number of such Honorary Life Members from India shall not exceed ten and the number of such Honorary Life Members from other countries shall not exceed twenty. The Council shall frame rules for the election of such Honorary Life Members and in regard to the manner of bestowing the honour on them.

13. *Members* : Every candidate for admission to the Institution as a Member or for transfer from Associate Member to Member, shall produce evidence satisfactory to the Council that he complies with the following conditions :

(1) Age—He shall be not less than thirty-five years of age.

(2) Occupation—He shall be engaged in the profession of engineering in a position of high responsibility, or shall have retired from the profession after having held, before his application for election or transfer, a position of high responsibility.

(3) Attainments—He shall have attainments by virtue of his educational qualifications and/or experience which will comply with one of the following alternative conditions :

(A)(a) He shall either be an Associate Member or shall have fulfilled the conditions necessary for Associate Membership ; and

(b) He shall have had at least five years' experience in a position of responsibility in the design and/or execution of important engineering works and/or teaching in engineering and/or research in engineering.

(B) He shall have had experience in a position of responsibility as laid down in (A)(b) above for a period of not less than fifteen years.

(C) He shall have been an Associate Member for a continuous period of fifteen years prior to the date of his application for transfer to Member.

14. *Associate Members :* Every candidate for admission to the Institution as an Associate Member or for transfer from Graduate or Student to Associate Member shall produce evidence satisfactory to the Council that he complies with the following conditions :

(1) Age—He shall be not less than twenty-five years of age.

(2) Occupation—He shall have been engaged in the design and/or execution and/or operation of engineering works and/or teaching in engineering and/or research in engineering in a position of responsibility.

(3)(a) Examinations—He shall have passed Sections A and B Examination for Associate Membership prescribed by the Council or such other examination or examinations as are recognized by the Council as exempting therefrom.

(b) He may be further required to appear for a written and/or oral test or produce evidence of his experience by a report or dissertation on the work done by him. The Council may in its discretion dispense with this requirement in appropriate cases.

(4) Training and Experience—He shall have further received engineering training and practical experience (which includes teaching and research in engineering) for a total period of not less than seven years which shall include a period of not more than three years as a Student of the Institution or as a student or trainee or pupil or apprentice in an engineering college or institution or in an engineering office or works to the satisfaction of the Council.

A Graduate of the Institution of a standing of more than five years or such period as the Council may prescribe from time to time shall be considered to have satisfied the requirements of Bye-Laws 14(3) and 14(4).

15. *Companions :* Every candidate for admission to the Institution as a Companion shall be not less than thirty-three years of age, and shall be a person, who though not an engineer by profession, yet by reason of his attainments in science or in any of the arts allied to or having interests in common with engineering, may be deemed by the Council to be worthy of the distinction of being elected a Companion.

16. *Graduates :* Every candidate for admission to the Institution as a Graduate, or for transfer from Student to Graduate, shall produce evidence satisfactory to the Council that he complies with the following conditions :

(1) Age—He shall be not less than twenty-one years of age. No person shall remain a Graduate after the completion of his fortieth year.

(2) Occupation—He shall be actually engaged in engineering work at the time of his application for election and shall, in the opinion of the Council, be making satisfactory progress in the acquisition of qualifications for Associate Membership.

(3) Examinations—He shall have passed Sections A and B Examination for Associate Membership or such other examination or examinations as are recognized by the Council as exempting therefrom.

(4) Training—He shall be receiving or have received such regular training as an engineer as would, in due course, fit him for responsible employment as an engineer.

17. *Students :* Every candidate for attachment to the Institution as a Student shall be a person not less than seventeen years of age who is qualifying himself for the profession of an engineer as a pupil, apprentice or assistant under a Corporate Member, or being trained in a recognized engineering institution, or is obtaining training and experience in a manner approved by the Council. He shall have passed an examination for Studentship prescribed by the Council or such other examination or examinations as are recognized by the Council as exempting therefrom. The Council may call for such reports from a Student in regard to the work in which he is engaged as it may consider necessary, and failure to submit such reports to the satisfaction of the Council shall be adequate reason for discontinuing his attachment.

18. *Subscribers :* The Council may, at its discretion, attach to the Institution as a Subscriber any State, Department of Government, Public Body, Registered Company, Firm or individual, not eligible to be a Member, Associate Member or Companion, who may desire to be so attached. Each Subscriber shall be entitled to attend (or if the Subscriber be other than an individual) to depute a representative, not being a person eligible for election as a Corporate Member to attend the Ordinary General Meetings and Ordinary General Professional Meetings.

19. *Technicians :* Every candidate for attachment to the Institution as a Technician shall produce evidence satisfactory to the Council that he complies with the following conditions :

(1) Age—He shall be not less than twenty-one years of age.

(2) Occupation—He shall be actually engaged in the position of a supervisor or foreman or other equivalent position in the design and/or execution of engineering works and/or operation of engineering works and/or teaching of engineering techniques and/or assisting in engineering research.

(3) Examination—He shall have passed an examination for Technicians prescribed by the Council or such other examination or examinations as are recognized by the Council as exempting therefrom.

(4) Training—He shall have received regular training to the satisfaction of the Council as would in due course fit him for employment as a supervisor or foreman or other equivalent position.

Election of Members and Attached Persons

20. Any person desirous of being elected a Member or Associate Member or being transferred from Associate Member to Member shall be proposed and recommended by his supporters from personal knowledge according to the provisions and the appropriate form prescribed in the Regulations.

21. Any person desirous of being elected a Companion shall be proposed and recommended by his supporters from personal knowledge according to the provisions and the appropriate form prescribed in the Regulations.

22. Any person desirous of being elected a Graduate shall be proposed and recommended by his supporters from personal knowledge according to the provisions and the appropriate form prescribed in the Regulations.

23. Any person desirous of being attached as a Student shall be proposed and recommended by his supporters from personal knowledge according to the provisions and the appropriate form prescribed in the Regulations.

24. Any person desirous of being attached as a Technician shall be proposed and recommended by his supporters from personal knowledge according to the provisions and the appropriate form prescribed in the Regulations.

25. A candidate applying under Bye-Laws 20, 21, 22, 23 and 24 shall give sufficient evidence to the satisfaction of the Council of the correctness of his statements made in the application form.

26. Each proposal form completed as required by the Regulations in relation to Member, Associate Member, Companion, Graduate, Student or Technician shall be submitted to the Secretary with such application fee as may be specified by the Council from time to time.

27. (a) On each proposal form for Corporate Member, the Secretary shall annex thereto his remarks as to whether or not the qualifications of the candidate appear to be in accordance with the provisions of the Bye-Laws ;

(b) The Secretary shall then forward the proposal form with his note aforesaid for remarks to the Honorary Secretary of the Local Centre within the boundaries of which the candidate resides or practises or carries on business ;

(c) The Honorary Secretary of the Local Centre shall obtain the opinion of the Committee of the Local Centre, record it in the space set apart for the purpose, and return it to the Secretary ;

(d) The Secretary shall then forward the proposal form to the Chairman of the Division Council concerned for his recommendation ;

(e) If the Chairman of the Division agrees with the recommendation of the Committee of the Local Centre in so far as the grade of Associate Member is concerned, he shall, on behalf of the Council, declare the proposal as approved by the Council or as not approved by the Council as the case may be ;

(f) In the following cases, however, the Secretary shall take a postal vote of the Council :

(i) In case the Chairman of the Division Council differs from the recommendation made by the Committee of the Local Centre.

(ii) In case the recommendation made by the Committee of the Local Centre and the Chairman of the Division Council is for the grade of Member.

(iii) In case of transfer from Associate Member to Member.

In scrutinizing the result of the postal ballot, each negative vote shall be taken as equivalent to one positive vote. The Secretary shall then, on behalf of the Council, declare the proposal as approved by the Council or as not approved by the Council as the case may be.

28. (a) On each proposal form for Companion, Graduate and Student, the Secretary shall annex thereto his remarks as to whether or not the qualifications of the candidate appear to be in accordance with the provisions of the Bye-Laws ;

(b) The Secretary shall then forward the proposal form with his note aforesaid for remarks to the Honorary Secretary of the Local Centre within the boundaries of which the candidate resides or practises or carries on business ;

(c) The Honorary Secretary of the Local Centre shall obtain the opinion of the Committee of the Local Centre, record it in the space set apart for the purpose, and return it to the Secretary ;

(d) The Secretary shall then, on behalf of the Council, accept the recommendation of the Committee of the Local Centre, and declare the proposal as approved by the Council or as not approved by the Council as the case may be ;

(e) In case of any difference of opinion at any of the above stages, the Secretary shall, however, take a postal vote of the Council thereon.

The postal vote shall be scrutinized by the Secretary in the same manner as in Bye-Law 27, and he shall then, on behalf of the Council, declare the proposal as approved by the Council or as not approved by the Council as the case may be.

29. Proposal forms for Technician, after their receipt by the Secretary, shall be processed according to the manner prescribed in the Regulations.

30. Every candidate for the grade of Member or Associate Member on his election or transfer shall be forthwith notified of the fact by the Secretary in accordance with the appropriate form prescribed in the Regulations.

31. Every candidate for the grade of Companion, Graduate, Student or Technician on his attachment shall be forthwith notified of the fact by the Secretary in accordance with the appropriate form prescribed in the Regulations.

32. The Secretary shall give notice of every such election or attachment to the Honorary Secretary of the Local Centre within the boundaries of which the candidate resides or practises or carries on business.

Rights and Privileges

33. Subject to the provisions of the Charter and to the restrictions contained in the Bye-Laws :

(a) Honorary Life Members and Members shall enjoy all the rights and privileges of the Institution.

(b) Associate Members shall enjoy the rights and privileges of the Institution save only that they shall not be eligible to hold office as President or Vice-President/Chairman of a Division or Chairman of a Local Centre.

(c) Companions, Graduates, Students and Technicians shall enjoy the rights and privileges of the Institution save that they shall not be eligible to hold any office and shall not have any right of voting.

34. The rights and privileges of every Honorary Life Member, Member, Associate Member, Companion, Graduate, Student and Technician shall be personal to himself and shall not be transmissible by his own act or by operation of law.

35. Honorary Life Members, Members, Associate Members, Companions, Graduates, Students, Subscribers and Technicians who are or may become subjects of any Foreign State shall cease to belong to the Institution on the declaration of a state of war between that Foreign State of which they are subjects and India, and on such declaration their names shall be removed from the Roll of the Institution and they shall not be eligible for re-election so long as such state of war shall continue.

Expulsion and Disciplinary Action

36. (1) The Council shall have the right to expel from the Institution any Member, Associate Member, Companion, Graduate, Student, Subscriber or Technician who shall have, in the opinion of the Council, wilfully acted in contravention of the Charter or the Bye-Laws or the Regulations from time to time in force under the Bye-Laws, or who, in the opinion of the Council, shall have been guilty of such conduct as shall render him unfit to belong to the Institution, provided that :

(a) The meeting of the Council at which the resolution shall be passed shall be specially convened for the purpose, and the person concerned shall have been given a clear thirty days' notice that his conduct is to be inquired into, and he is given an opportunity of stating his case to the Council ;

(b) The resolution shall be passed by a majority of two-thirds of those present ;

(c) The Council shall have the right to expel from the Institution such person who gets admission on wilful misrepresentation.

(2) Upon a resolution of expulsion being passed, the person concerned shall cease to have any connection with the Institution. Neither the Council nor any one serving on the Council shall be liable for anything done under this Bye-Law. Every Corporate Member, Non-Corporate Member and Attached Person applying for admission to the Institution shall be deemed in so applying to agree to accept as final any decision of the Council under this Bye-Law.

(3) Every person so expelled shall be called upon by the Secretary to return immediately his Diploma or Certificate to the Secretary.

(4) The Council shall also have the right to take any disciplinary action against any Corporate Member, Non-Corporate Member or Attached Person. The procedure laid down above shall be followed in those cases also where the acts complained against may not warrant expulsion but may warrant some other disciplinary action. The decision of the Council shall be final and binding in such cases also.

The Council

37. The Council shall consist of the President, two immediate Past-Presidents, Chairman of the Local Centres during the period of their office, three Corporate Members from each Division who shall be elected by the Corporate Members of that Division on an all-India basis, and eighteen other Corporate Members who shall be elected by the Corporate Members of the Local Centres, the number of seats allotted to each Local Centre being proportional to the strength of Corporate Members at that Local Centre. The strength of the Council shall not exceed sixty-four.

All these elections shall take place by the method of proportional representation with a single transferable vote.

38. The Council shall elect the President from amongst the Members of the Council. The two immediate Past-Presidents shall not however be eligible for election as President. The eligibility of the President for re-election is defined under Bye-Law 39. The election of the President shall take plce by the method of proportional representation with a single transferable vote.

39. The President shall retire at the Annual General Meeting of the Institution at the termination of his year of office but shall be eligible for re-election for a further period of office as President for one year only, but after completion of his period of office (of one year or two years as the case may be), he shall not be eligible for re-election until after a period of four years.

40. The President shall be *ex-officio* a member of all Committees of the Council and of all the Division Councils.

41. In the event of the President being unable to perform the duties of his office due to death, resignation or any other cause, or in the case of absence or leave until he reassumes charge after the expiry of leave, the senior Vice-President shall assume all the duties of the President until a new President is elected and has taken over charge at the

Annual General Meeting. The seniority of the Vice-Presidents shall be based upon the continuous number of years that the Vice-Presidents concerned have been on the Roll of the Institution as Corporate Members.

42. The Chairmen of the Division Councils during the period of their office shall be *ipso facto* Vice-Presidents of the Council.

43. Members of the Council elected from the Divisions and the Local Centres shall hold office for a period of four years.

Divisions

44. Each Division of the Institution shall be managed by its own Division Council constituted in accordance with the Bye-Laws.

45. All Members of the Council belonging to a particular Division shall constitute the Division Council of that Division. If the number of members of any Division Council is less than four, then the Division Council may co-opt additional members so as to have four members on the Division Council including the Chairman. Such co-opted members shall not be members of the Council and shall also not be eligible for election as Chairman of the Division Council.

46. The Division Council of every Division shall elect a Chairman from amongst the members of the Division Council by the method of proportional representation with a single transferable vote. The Chairman of the Division Council shall retire at the Annual General Meeting of the Institution but shall be eligible for re-election for a further period of office as Chairman for one year only, but after completion of his period of office as Chairman (of one year or two years as the case may be), he shall not be eligible for re-election until after a period of three years. The Chairman of the Division Council shall be *ex-officio* a member of all the committees of the Division. In the event of the Chairman being unable to perform the duties of his office due to death, resignation or any other cause, or in the case of absence or leave until he reassumes charge after the expiry of leave, the Division Council shall appoint another Chairman from amongst the members of the Division Council.

47. In case any member of the Council belongs to more than one Division he shall, on election to the Council intimate the Secretary the name of the Division Council to which he elects to work. He shall not then have the right to be a member of any other Divison Council.

48. The Division Councils of more than one Division may decide to act as a Joint Division Council during the term of the Division Councils concerned. Such decision shall be given effect to if the decision to that effect is taken separately by the respective Division Councils.

49. The Division Councils of the Divisions shall exercise such powers, functions and duties as the Council may delegate to them from time to time.

Election of the Council

50. The Secretary shall, before the 30th June preceding each Annual General Meeting, arrange to hold elections to fill vacancies in the Council from the Divisions on an all-

India basis and at the Local Centres as required under Bye-Law 37. These elections shall take place by the method of proportional representation with a single transferable vote.

51. If there is any casual vacancy in the Council by death or resignation, the same shall be filled by the Council by co-option for the remaining term of that seat.

If there is any casual vacancy in the Council due to leave or absence of any Member of the Council, the same may be filled by the Council by co-option for the duration of the leave only.

52. If the Chairman of a Local Centre who is entitled to be a member of the Council during the period of his office is already a member of the Council, then in such a case the Local Centre concerned shall have the right of nominating one Corporate Member from that Centre as a Member of the Council during the period of office of the Chairman.

53. A Corporate Member shall not seek election to the Council from more than one constituency.

Secretary

54. A Secretary employed by the Institution shall by appointed and removed by the Council, who shall determine the length of the engagement, salary, powers and duties to be performed by him.

55. (1) The Secretary shall carry out all his duties under the direction of the Council. He shall, unless exempted from the provisions hereof by the Council devote his whole time to the business of the Institution and shall not engage in any other business or profession.

(2) He shall be responsible for all correspondence, accounts and offce work of the Institution; he shall receive and transmit to the Bankers all funds and moneys paid to the Institution unless the Council shall appoint in his place for that purpose some other person; he shall attend all meetings of the Council and shall have the business thereat correctly and fully recorded and reported; he shall have charge of all the property of the Institution save only the funds and moneys in the custody of the Bankers; he shall maintain a Roll of the names of Honorary Members, Honorary Life Members, Members, Associate Members, Companions, Graduates, Students, Subscribers and Technicians and of their addresses; he shall direct the collection of subscriptions and other moneys due to the Institution; he shall engage (subject to the approval of the Council) and be responsible for all persons employed under him and arrange their work and duties, and shall generally conduct the ordinary business of the Institution.

(3) The powers of the Secretary shall be specified in the Regulations, and may be modified by the Council from time to time.

Bankers

56. The Bankers of the Institution shall be the State Bank of India or one or more Scheduled Banks (as defined by Section 2 of the Reserve Bank of India Act of 1934) having head offices in the Indian Union as may be determined by the Executive Committee.

Auditors

57. (a) The Institution shall, at each Annual General Meeting appoint one or more properly qualified Auditor or Auditors to hold office until the next Annual General Meeting.

(b) A Member of the Council, a member of a Division Council, or officer of the Institution shall not be eligible of being appointed an Auditor of the Institution.

(c) The Council may fill any casual vacancy in the office of Auditor, but while any such vacancy continues the surviving or continuing Auditor or Auditors (if any) may act.

(d) The remuneration of the Auditors of the Institution shall be fixed by the Institution at the Annual General Meeting at which they are appointed except that the remuneration of any Auditor appointed to fill any casual vacancy may be fixed by the Council.

Powers and duties of the Council

58. The government and control of the Institution and its affairs shall be vested in the Council. The Council shall exercise all powers of the Institution not otherwise specially provided for and all powers which are necessary for attaining the objects of the Institution. In the government and control of the Institution and its affairs, the Council shall be subject to such directions (not being inconsistent with the provisions of the Charter or the Bye-Laws) of the Institution in General Meeting, but no such direction shall invalidate any prior act of the Council which would have been valid if that direction had not been given. The Council may delegate such of its powers to the following persons and bodies as it finds necessary from time to time.

(a) The Executive Committee of the Council.

(b) The Division Councils of the different Divisions.

(c) The President.

(d) The Vice-Presidents/Chairman of the Division.

(e) The Secretary.

(f) Such other person or persons or bodies as the Council may appoint or constitute from time to time for the efficient working of the Institution.

59. In particular and without prejudice to the generality of the powers and duties exercisable by the Council, the Council shall have the following powers, duties and functions :

(a) To prescribe standards and conditions for admission into or attachment to the Institution.

(d) To frame and/or approve of Regulations not inconsistent with the Charter or the Bye-Laws for carrying out the objects of the Institution.

(c) To institute and confer diplomas, certificates and other distinctions for recognition of competence or extraordinary merit in engineering, trade, science or the profession, and to institute examinations.

(d) To arrange for the publications of the Institution.

(e) To cooperate with other bodies engaged in activities allied to engineering in such manner and for such purposes as the Council may determine.

(f) To define the functions, powers and duties of the Executive Committee, the Division Councils, the Secretary, the Local Centres, and other bodies and persons appointed or constituted for carrying out the objects of the Institution.

(g) To approve of the rules prepared by the Executive Committee and the Division Councils.

(h) To delegate any of its powers, functions and duties to any person or persons or bodies or committees as mentioned in the Bye-Laws.

(i) To amalgamate any other body or association of engineering and to elect or attach such of its members and others as the Council may decide to appropriate grades of Members and Attached Perons in the Institution.

(j) To exercise the power of overriding control on the administration of the Institution including the working of the Executive Committee, the Division Councils, the Secretary, the Local Centres, and other bodies and persons which may be constituted or appointed either by the Council or by any other authority on behalf of the Council.

Council Meetings

60. The Council shall meet not less than twice in a year. The notice of such meeting shall be given to each member of the Council together with the agenda not less than fourteen days before the date of the meeting. The period of fourteen days does not apply to supplementary agendas which may be issued as the exigencies of the case may require. This is subject to the proviso that only urgent matters as cannot wait till the next meeting of the Council shall be included in the supplementary agendas. Very urgent matters for which no notice is given may be taken at the meeting of the Council as a special case if the Council agrees that the matter is very urgent.

61. The Secretary shall summon, with the approval of the President, a special meeting of the Council on receipt on a requisition in writing signed by at least twenty members of the Council. The notice of such special meeting shall state the purpose for which the meeting is called. Twenty-one days' notice for such a meeting shall be given.

62. A meeting of the Council at which a quorum is present shall be competent to exercise all or any of the authorities, powers and discretions vested in or exercisable by the the Council. Twenty members shall constitute a quorum for the Council. If at any meeting there is no quorum, the Council shall stand adjourned for twenty-four hours and shall meet at the same place and transact the business of the meeting. No quorum is required for such adjourned meeting.

63. Subject as hereinafter provided, questions arising at any meeting of the Council shall generally be decided by a majority of votes : the President shall have a second or casting vote, provided nevertheless that a postal vote shall be taken whenever :

(a) the meeting of the Council shall so direct;

(b) any six present at the meeting shall demand it;

(c) any twelve, whether present at the meeting or not, shall, by notice in writing delivered to the Secretary not less than seventy-two hours before the hour fixed for the meeting, demand it.

Executive Committee

64. The President, the Vice-Presidents, and three other members of the Council elected by the Council annually shall constitute the Executive Committee. The Executive Committee shall exercise its powers, functions and duties in accordance with the directions of the Council.

The powers of the Executive Committee shall be specified in the Regulations, and may be modified by the Council from time to time.

Powers of Division Councils

65. Until and unless the Regulations otherwise direct, a Division Council shall exercise the following powers. duties and functions :

(a) To direct the activities of the Division in attaining the objects of the Institution in that particular Division.

(b) To advise the Council in regard to matters in which the Division is interested.

66. Subject to the Regulations and other directions of the Council, each Division Council shall decide its own procedure regarding the meetings of the Division Council.

General Meetings

67. General Meetings shall be held at such places and at such times as the Council shall decide but so that one of such meetings (referred to in these Bye-Laws as the 'Annual General Meeting') shall be held in the month of November or December or January in every year. Every General Meeting other than the Annual General Meeting shall be called an 'Ordinary General Meeting'.

68. General Meetings of the Institution shall be of the following categories :

(a) Annual General Meeting called for the business prescribed in the Bye-Laws.

(b) Ordinary General Meeting called by the Council for the business prescribed by resolutions of the Council.

(c) Ordinary General Professional Meetings held for discussion of matters of interest to the growth of the science and profession of engineering.

Annual General Meetings shall always be followed by Ordinary General Professional Meetings.

Business at the Annual General Meeting mentioned in (a) and of the Ordinary General Meeting mentioned in (b) above shall be governed by Bye-Laws 69, 70, 71, 72 and 73. Ordinary General Professional Meetings may be held Divisionwise, and may be presided by a Corporate Member considered competent and interested in the subject matter of discussion. The Council shall frame rules for the holding of such Ordinary General Professional Meetings at the Local Centres and at other places all the year round.

69. Ordinary General Meetings shall be conducted as follows: The Chair having been taken, any communication prescribed by the Bye-Laws or deemed advisable by the Council shall then be made and discussed. Motions emanating from the Council shall shall then be announced and discussed and voted upon or adjourned for discussion at a subsequent meeting, after which motions of which not less than twenty days' notice in writing to the Secretary has been given (except by consent of the Chairman which shall not be given if a majority of the Corporate Members present shall, on being informed of the substance of the motion, vote by show of hands against the motion being put) and which are duly seconded shall be discussed and voted upon or adjourned for discussion at a subsequent meeting. Amendments to motions shall be in writing unless excused by the Chairman. Not more than a single amendment to the original motion shall be laid before the meeting at one time. When any such amendment has been negative, or has to be allowed to take the place of the original motion, other amendments involving a fresh point may be proposed. No one other than a Corporate Member shall speak on any motion or amendment except by invitation or permission of the Chairman, and no one shall speak more than once except by pemission of the Chairman on any motion or amendment except the mover thereof, who shall be entitled to reply on the points raised in the discussion before a vote is taken on the motion or amendment.

70. At the Annual General Meeting, the Annual Report of the Institution together with the Audited Accounts for the preceding financial year shall be presented by the Council to be considered and, if approved, to be passed by the meeting. The names of the new President, Vice-Presidents/Chairmen of the Divisions, Chairmen of the Local Centres, and Members of the Council shall then be announced, and they shall thereupon be deemed to have entered into office, and the retiring President, Vice-Presidents/Chairmen of the Divisions, Chairmen of the Local Centres, and Members of the Council shall be deemed to have vacated office. The Chair shall then be vacated and filled again as hereinafter prescribed. The meeting shall then proceed with the current business of the Institution as hereinafter prescribed for an Ordinary General Meeting.

71. (1) An Extraordinary General Meeting may at any time be called by the Council and shall be called by the Council on a requisition signed by not less than one hundred Corporate Members of whom not less than fifty shall be Members. The requisition shall state the objects of the meeting and must be signed by the requisitionists and deposited at the Office and may consist of several documents in like form singed by one or more requisitionists.

(2) At an Extraordinary General Meeting only the special business of which notice has been given or such questions as necessarily arise thereon shall be considered, and no one other than Honoray Life Members, Members and Associate Members shall be permitted to be present thereat, and to them only shall notice of the meeting be sent.

72. The proceedings at all General Meetings shall be regulated as follows:

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(a) The President, if present, shall take the Chair, and in his absence one of the Vice-Presidents, or in their absence the senior Member of Council present. If neither the President, a Vice-President nor any Member of the Council be present on the expiry of fifteen minutes after the hour fixed for the meeting, the Corporate Members present shall proceed to elect a Chairman from their number.

(b) Fifty Corporate Members shall constitute a quorum. In the event of a quorum not being present within thirty minutes of the hour fixed for the commencement of the meeting, the meeting shall stand adjourned to the same hour and place on the following day when the members present whatever their number shall constitute a quorum.

(c) Twenty-one days' notice at the least (exclusive of the day on which the notice is deemed to be served, but inclusive of the day for which which notice is given) specifying the place, the day and the hour of any General Meeting, and in case of the Annual General Meeting a copy of the Audited Accounts shall accompany the notice, and in case of special business, shall be given, except as hereinafter provided to all Members and Attached Persons by post to their registered addresses in India; but the non-receipt of the notice by any person entitled by this Bye-Law to receive it shall not invalidate the proceedings of any General Meeting.

73. At all General Meetings, every Corporate Member shall have one vote and, save as otherwise hereinafter expressly provided, votes shall ordinarily be taken from those only personally present at the meeting and by show of hands but a poll may be demanded by any person entitled to vote. The Chairman shall be entitled to a vote and when votes are equal, he shall have an additional or casting vote.

74. Votes by means of voting papers sent through post shall be taken (a) in the case of postal vote of the Council from the President, Vice-Presidents/Chairmen of the Divisions, Chairmen of the Local Centres, and Members of the Council, (b) in the case of a postal vote of the Institution from all Corporate Members. A postal vote of the Institution shall be taken :

(a) when expressly prescribed to be so taken by the Bye-Laws;

(b) when, in its opinion, the Council considers it in the interests of the Institution that an appeal should be made from a decision of an Ordinary General Meeting to the whole body of the Institution; and

(c) when otherwise, in its discretion, the Council thinks fit or necessary.

In all cases the subject matter to be voted on with such explanation as may be necessary shall be circulated to every member entitled to vote. This circular shall specify the place and date of return, and shall be issued not less than thirty days prior to that date of return. Any votes received after that date shall not be considered.

75. No person appointed to any office in the Institution to which a salary is attached shall have the privilege of voting at a General Meeting of the Institution. If a Corporate

Member be appointed to any such office, he shall be incapable of voting for so long as he continues to hold it, but shall not be deprived of any of his privileges.

Register of Members and Attached Persons

76. Every Honorary Life Member, Member, Associate Member, Companion, Graduate, Student, Subscriber and Technician shall register with the Secretary an address in India to which all notices and communication may be sent to him, and if he shall register no address in India, he shall not be entitled to any notice, and such registered address may from time to time be changed by him on notice to the Secretary, and all notices addressed to any Member, Associate Member, Companion, Graduate, Student, Subscriber or Technician posted to his registered address in India for the time being, shall be deemed to be effectively served and made, notwithstanding that through absence or otherwise the addressee may not in fact have received the notice or communication. Where a notice is sent by post, service of the notice shall be deemed to be effected by properly addressing, prepaying and posting a letter containing the notice and to have been effected at the time at which the letter would be delivered in the ordinary course of post.

Additions and Alterations of Bye-Laws

77. (1) Meeting of the Corporate Members of the Institution for the purposes of considering any question as to the making, revocation, alteration or amendment of any Bye-Law or Bye-Laws in pursuance of the provisions of Clause 17 of the Charter shall be called by the Council whenever the Council decide to call such a meeting and whenever they are required so to do by a requisition signed by not less than one hundred Corporate Members of whom not less than fifty shall be Members. The requisition shall state the matters required to be taken into consideration at the meeting and must be signed by the requisitionists and deposited at the Office, and may consist of several documents in like form signed by one or more requisitionists.

(2) The meeting shall be held at such place as the Council may decide, and two weeks' notice at the least (exclusive of the day on which the notice is deemed to be served, but inclusive of the day for which notice is given) specifying the place, day and hour of the meeting and the matters to be taken into consideration thereat shall be given to all the Corporate Members of the Institution by post to their registered address in India.

(3) The meeting shall be held in accordance with the rules for General Meetings as prescribed in Bye-Law 72.

78. Notice of the making, revocation ,alteration or amendment of any of the Bye-Laws shall be published in the appropriate publication of the Institution as soon as is reasonably practicable, and the same shall be deemed to be duly served on Honorary Life Members, Members, Associate Members, Companions, Graduates, Students, Subscribers and Technicians, and such service shall be deemed to be effected, unless a later date is specifically stated in the notice, on the date of issue of the publication in which the notice appears.

Funds, Investments and Accounts

79. The income and property of the Institution, whensoever derived, shall be applied solely to the promotion of the business and objects of the Institution as set forth in the

Charter. No member of the Council shall be appointed to any salaried office of the Institution and no remuneration shall be given by the Institution to any Member of the Council except repayment of out-of-pocket expenses and interest on money lent or rent for premises demised to the Institution.

80. All compounding fees, received from Members, Associate Members, Companions and Subscribers, and all admission fees shall be regularly invested, as soon as possible after the receipt thereof by the Bankers, as instructed by the Executive Committee in any one or more of the securities appearing in the List of Securities appended to the Bye-Laws, and only the interest accruing therefrom shall be available for the general expenditure of the Institution. Such moneys and investments shall form the Permanent Reserve Fund. The Executive Committee shall be at liberty :

(a) To vary the investments at their discretion within the limits of approved securities;

(b) To deposit all or any of the securities representing the Permanent Reserve Fund with the Bankers of the Institution to secure an overdraft on current account not exceeding Rs. 50,000 at any time; and

(c) To spend any portion of the Permanent Reserve Fund in purchasing land, buildings, furniture and equipment for the Institution and/or any Local Centre.

Save as aforesaid, no portion of the Permanent Reserve Fund shall be alienated without the consent of the Institution, to be obtained by a postal vote, on which vote the majority shall be not less than three-fourths of the effective votes received.

The Executive Committee shall have the power to make from time to time such additions as they consider desirable to the Permanent Reserve Fund from the General Funds of the Institution and the provisions of the Bye-Laws shall apply to these additions exactly as if they had formed part of the receipts required by the Bye-Laws to be invested for forming that Fund.

81. All the securities and moneys, the property of the Institution, shall be lodged with the Institution's Bankers in the name of the Institution. Any surplus funds not required for the current expenditure and not carried by the Executive Committee to the Permanent Reserve Fund shall be invested from time to time by the Bankers, as instructed by the Executive Committee, in any one or more of the securities appearing in the List of Securities appended to the Bye-Laws as a Temporary Reserve Fund; and no securities forming part of this Fund shall be sold or otherwise disposed of except by order of the Executive Committee.

82. True accounts shall be kept of the sums of money received and expended by the Institution and the matters in respect of which such receipts and expenditure take place, and of the property, credits and liabilities of the Institution. The account of the receipts and expenditure shall be considered monthly by the Executive Committee of the Council. The accounts shall be audited not less often than once annually by the Auditor or Auditors of the Institution. The Audited Accounts of the preceding financial year shall be presented by the Council for consideration and passing with the Annual Report (of

which they shall form part) at each Annual General Meeting and they shall be printed in the form of:

(a) a Balance Sheet, and a Permanent Reserve Account,

(b) one or more Revenue and Expenditure Accounts, and

(c) separate accounts of endowments or trust funds created for specific purposes, in the appropriate publication of the Institution as soon as possible after the Annual General Meeting.

83. All donations to the Institution shall be enumerated in the Annual Report of the Council presented to the Annual General Meeting.

84. No payments from the moneys or funds of the Institution shall be made except by direction of the Executive Committee under the express or implied sanction of the Council, and all cheques shall be signed by the Secretary and one member of the Executive Committee.

Administration of Local Centres

85. The constitution of the Committees of the Local Centres shall be prescribed in the Regulations by the Council.

The Council shall have overriding powers in all matters concerning the administration and working of the Local Centres.

Regulations

86. The Council shall have the power to frame Regulations if and when necessary for the proper execution of the Charter and the Bye-Laws. As to the interpretation of the Charter and the Bye-Laws, the decision of the Council shall be final. The Council shall also have power to revise or modify the Regulations subject to confirmation at the Annual General Meeting.

APPENDIX TO THE BYE-LAWS

List of Securities

Referred to in Bye-Law 80 (Permanent Reserve Fund) and Bye-Law 81 (Temporary Reserve Fund)

1. Debentures, stock or securities of the Central Government or of any State Government.

2. Debentures, stock or securities of a corporate body, both the principal whereof and the interest whereon shall have been fully and unconditionally guaranteed by the Central Government or State Government(s).

3. Debentures or other securities for money issued, under the authority of any Central Act or Act of a State Legislature, by or on behalf of any municipal body, Port Trust, City Improvement Trust or autonomous corporation.

INSTITUTION NOTICES

Papers on latest developments in engineering

The response to the request made in the June 1962 issue of the *Bulletin* for suggesting titles for writing out review papers on the latest developments in a number of engineering fields of current interest has been very good. In continuation of the previous list, the following topics are suggested. Authors who like to review one or more of the subjects listed may kindly correspond with Prof. N. S. Govinda Rao, Convener, Engineering Research Committee, and Professor of Civil and Hydraulic Engineering, Indian Institute of Science, Bangalore 12. Further lists of subjects for review in all branches of engineering may also be kindly sent to the Convener, along with the names of authors competent to write them.

1. Development of high voltage D.C. transmission
2. Development of nuclear power
3. Application of digital computers in power system analysis
4. Use of series capacitors on H.V. transmission lines
5. Dynamic stability alternators
6. Protection of power systems
7. Design of large size alternators
8. Director conversion generators
9. Semi-conductor power rectifiers
10. Single-phase, 50 cycles/second electric traction
11. Modern trends in the design of electric lamps
12. Random inputs
13. Adaptive control systems
14. Multivariable control systems
15. Optimization of control systems
16. Sampled-data control systems with reference to
    - (a) Nonlinear sampled data control systems
    - (b) Variable rate sampled systems
    - (c) Samples systems with definite pulse width
17. Nonlineal mechanisms
18. Liapunov's second method for the study of nonlinear differential equations
19. Recent developments in prestressed concrete
20. Precast concrete—the right approach for speedy construction
21. Composite construction in steel and concrete
22. Prestressed post-tensioned R.C. work in bridges and buildings
23. Use of shell concrete roof particularly in industrial structures
24. Use of tubular structures and their comparative economy and speed in erection
25. Trend of tall buildings in urban development
26. Recent failures of important structures

27. Trend of researches in building industry
28. Trends in the design of surge tank
29. Trends in the design of canals
30. Fluidization
31. Mass transfer
32. Thermodynamic and transport properties

Proposed Symposium on 'Anologies in Engineering' at the 43rd Annual Convention, Bangalore

It is proposed to hold a Symposium on 'Analogies in Engineering' at the Electrical Engineering Division during the 43rd Annual Convention of the Institution in early February 1963 at Bangalore. Papers are invited for the Symposium. Intending contributors should send the manuscripts on or before November 30, 1962, to the Technical Officer (Scientific), at the Institution address, so that suitable papers can be considered and a proper programme can be drawn up for their presentation at the Symposium.

The topics that may be dealt with for the Symposium papers are:

1. Introductory—idea of analogies in engineering problems
2. Use of analogies in the design of feedback control systems
3. Analogue methods for the use of electromagnetic field problems
4. Analogue computer as tool in the analysis and design of electrical machinery
5. Hydraulic engineering problems—reduction into electrical equivalent circuit or field problems,
6. Mechanical engineering problems—reduction into electrical equivalent circuit or field problems
7. Thermal problems—reduction into electrical equivalent circuit problems
8. Dimensional analysis and model studies
9. Resume or conclusion—methods of analysis.

Any other points of view relevant to the subjects may be added or chosen for discussion.

Revised rates of subscriptions

The revised rates of subscriptions published in the June 1962 issue of the *Bulletin* will come into force (effective Institution Financial year 1963-64) after the minutes of the Meeting of Corporate Members, New Delhi, 31st March, 1962, for revision of Subscriptions, are confirmed at the next Annual General Meeting to be held at Bangalore in February 1963.

INSTITUTION NEWS

Revised Draft Code of Ethics for Corporate Members

(Effective August 12, 1962)

The revised Draft Code of Ethics for Corporate Members as adopted by the Council at its 426th Meeting held in Calcutta on August 12, 1962, is given below for information of members.

Foreword

A Corporate Member should recognize the principles of honesty, justice and courtesy to guide him in the practice of his profession and in his personal conduct. He should not merely observe them passively, but should apply them dynamically in the discharge of his duties to the public and the profession.

He should scrupulously guard his professional reputation and avoid association with any enterprise of questionable character. He should uphold the dignity and honour of the Institution.

The Code

1. A Corporate Member will cooperate with others in his profession by the free interchange of information and experience, and will contribute to the work of engineering institutions to the maximum effectiveness he is capable of.

2. A Corporate Member will endeavour to protect the engineering profession from misrepresentation and misunderstanding.

3. A Corporate Member will refrain from expressing publicly an opinion on an engineering subject unless he is informed as to the facts relating to that subject.

4. A Corporate Member will express an opinion only when it is founded on adequate knowledge and honest conviction if he is serving as a witness before a court or commission.

5. A Corporate Member will not divulge any confidential findings or actions of an engineering commission or committee of which he is a member, without obtaining official consent.

6. A Corporate Member will take care that credit for engineering work is given to those to whom credit is properly due.

7. A Corporate Member will not offer his professional services by advertisement or through any commercial advertising media, or solicit professional work either directly, or through an agent, or in any other manner derogatory to the dignity of the profession.

8. A Corporate Member will not submit a proposal for an engineering engagement unless he is invited to do so.

9. A Corporate Member will not directly or indirectly injure the professional reputation or practice of another Corporate Member.

10. A Corporate Member will exercise due restraint in criticizing the work of another Corporate Member and remember that the proper forum for technical criticism is an engineering society or the engineering press.

11. A Corporate Member will not try to supplant another Corporate Membe in a particular employment.

12. A Corporate Member will not compete unfairly with another Corporate Member by charging fees below those customary for others in his profession practising in the same field and in the same area.

13. A Corporate Member will not associate in work with an engineer who does not conform to ethical practices.

14. A Corporate Member will act in professinal matters for his client or employer as a faithful agent or trustee.

15. A Corporate Member will not misrepresent his qualifications to a client or employer or to the profession.

16. A Corporate Member will not disclose information concerning the business or technical affairs of his client or employer without his consent.

17. A Corporate Member will present clearly the consequences to be expected if his professional judgment is overruled by a non-professional authority where he is responsible for the professional adequacy of the work.

18. A Corporate Member will act with fairness and justice between his client or employer and the contractor when dealing with contracts.

19. A Corporate Member will not be financially interested in the bids as or of a contractor on competitive work for which he is emplyed as an engineer unless he has the written consent of his client or employer.

20. A Corporate Member will not receive any commission, discount or other indirect profit in connection with any work with which he is entrusted.

21. A Corporate Member will make his status clear to his client or employer before undertaking an engagement if he may be called upon to decide on the use of inventions or equipment or any other thing in which he may have a financial interest.

22. A Corporate Member will immediately inform his client or employer any interest in a business which may compete with or affect the business of his client or employer.

23. A Corporate Member will not allow an interest in any business to affect the engineering work for which he is employed or may be called upon to perform.

24. A Corporate Member will engage or advise engaging engineering experts and specialists when in his judgment such services are to the interests of his client or employer.

25. A Corporate Member will not review the work of another Corporate Member for the same client, except with the knowledge of the second Corporate Member, unless such engineering engagement or the work which is subject to review is terminated.

26. A Corporate Member will not accept financial or other compensation from more than one interested party for the same service, or for services pertaining to the same work, without the consent of all interested parties.

27. A Corporate Member will subscribe to the principle of appropriate and adequate compensation for those engaged in engineering work, including those in subordinate positions.

28. A Corporate Member will endeavour to provide opportunity for the professional development and advancement of engineers in his employ.

29. A Corporate Member will, if he considers that another Corporate Member is guilty of unethical, illegal or unfair practice, present the information to the Council of the Institution for action.

30. A Corporate Member who is engaged in engineering work in a country abroad will order his conduct according to the professional standards and customs of that country, adhering as closely as is practicable to the principles of this Code.

Misdemeanour in Institution Examinations

The Council have decided to cancel the result of Shri Madan Lal (S. 26172) for the May 1962 examination and debar him from appearing in the two immediately following examinations, *i.e.*, up to and including May 1963, for misdemeanour in the aforesaid examination.

CORRIGENDUM

TO VOL. 11, NO. 9, MAY 1962

Page 55, List of New Elections and Transfers. Instead of '30229 Shankar Shioramji Headaoo', please read '30229 Shankar Shioramji Hedaoo'.-

EMPLOYMENT SERVICE

This service is intended for the benefit of members of the Institution and for the Government, industrial and other organizations employing engineers. It is hoped that the employers will make full use of this service to obtain their requirement.

A small charge of Rs. 5 per insertion will be made to members for notices appearing in the 'Situations Wanted' column.

In the 'Situations Vacant' column a charge of Rs. 2 per line will be made.

Replies to advertisements should be addressed to Employment Service, The Institution of Engineers (India), P. O. Box No. 669, Calcutta 20, except where otherwise stated.

SITUATIONS WANTED

RETIRED COMMISSIONED OFFICER, M.I.E., can efficiently command any Branch Office as manager for any manufacturing firms in engineering, industrial and also other products in Madras or Vijayawada or Hyderabad. Good in administration and organization. Reasonable salary will be accepted. (Office Ref. E. S. 106).

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THE BULLETIN
OF
The Institution of Engineers (India)

SECRETARY & EDITOR: B. Seshadri, B.Sc., A.I.I.Sc., D.I.C., M.Sc.(Eng.), M.I.E.

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PROGRAMME

forty-third annual convention

BANGALORE
FEBRUARY 2-9, 1963

43RD ANNUAL CONVENTION
BANGALORE
FEBRUARY 2-9, 1963

The 43rd Annual Convention of the Institution will be held in Bangalore between February 2-9, 1963.

The Mysore Centre of the Institution will be the hosts on this occasion and are making all the necessary arrangements for a successful Convention and to make the stay of the delegates as enjoyable as possible.

THE ANNUAL GENERAL MEETING

Business Session

The Business Session of the 43rd Annual General Meeting will be held between 3.00 p.m. and 4.00 p.m. on February 2, 1963, at the Puttanna Chetty Hall, Sri Jayachamarajendra Road, Bangalore.

Results of election of the President for 1962-63, and members of the Council, and Division Chairmen for 1962-66 will be announced at this Session.

Inaugural Session

The Inaugural Session of the 43rd Annual General Meeting will be held at 9.00 a.m. on Sunday, February 3, 1963, at the Rabindra Nataka Mandir, Sri Jayachamarajendra Road, Bangalore.

Paper Meetings and Symposia

Paper Meetings and Symposia will be held at the Rabindra Nataka Mandir, Puttana Chetty Hall, and Haigh Memorial Hall on 3rd, 4th and 5th February, 1963, and the detailed programme will be given in the November issue of the *Bulletin*.

PROGRAMME

Thursday, January 31st, and Friday, February 1st, 1963

12.00 noon to 5.00 p.m.	Registration of local members at the Institution Office at Vidhana Veedhi (near Vidhana Soudha), Bangalore

Saturday, February 2, 1963

9.00 a.m. to 1.00 p.m. and 2.00 p.m. to 4.00 p.m.	Registration of outstation members at Rabindra Nataka Mandir
2.30 p.m. to 3.00 p.m.	Adjourned Meeting of the 1961-62 Council

3.00 p.m. to 4.00 p.m.	Business Session of the 43rd Annual General Meeting at Puttanna Chetty Hall
4.15 p.m. to 6.15 p.m.	Meeting of Flood Control Committee
5.00 p.m. to 6.30 p.m.	Students' Session at Puttanna Chetty Hall
6.30 p.m.	Tea

Sunday, February 3, 1963

9.00 a.m. to 11.00 a.m.	Registration of outstation members at Rabindra Nataka Mandir
9.00 a.m.	Inaugural Session of the 43rd Annual General Meeting at Rabindra Nataka Mandir
10.30 a.m.	Tea
11.00 a.m.	Sixth Sir M. Visvesvaraya Lecture by Dr. A. N. Khosla, Governor of Orissa
1.00 p.m.	Lunch at the pavilion adjacent to Rabindra Nataka Mandir
2.00 p.m to 3.00 p.m.	Meeting of Engineering Research Committee
3.00 p.m.	Address by Chairmen and Paper Meetings
8.00 p.m.	Annual Dinner at Lal Bagh, Bangalore

Monday, February 4, 1963

9.00 a.m. to 1.00 p.m. (with Tea at 11.00 a.m.)	Address by Chairmen and Paper Meetings
1.00 p.m.	Lunch at pavilion adjacent to Rabindra Nataka Mandir
2.00 p.m. to 5.00 p.m.	Paper Meetings
6.00 p.m.	At Home by Mysore Centre and Opening of Mysore Centre's Building
6.45 p.m. to 8.00 p.m.	Cultural Show at Rabindra Nataka Mandir

Tuesday, February 5, 1963

9.00 a.m. to 1.00 p.m.	Symposia and Paper Meetings
1.00 p.m.	Lunch at pavilion adjacent to Rabindra Nataka Mandir
2.00 p.m. to 4.00 p.m.	Symposia and Paper Meetings
4.00 p.m. to 5.30 p.m.	Closing Session
6.00 p.m.	Tea
6.45 p.m. to 8.00 p.m.	Cultural Show at Rabindra Nataka Mandir

Wednesday, February 6, 1963

8.00 a.m. to 1.00 p.m.	Visit to Indian Telephone Industries and Hindustan Aircraft (other than Council Members). Return to hotels for Lunch
9.00 a.m.	Meeting of the 1962-63 Council
2.00 p.m. to 3.00 p.m.	Meeting of Committee for Advancement of Engineering Education
3.00 p.m.	Visit to Sir M. Visvesvaraya Industrial Museum, Cubbon Park, Lal Bagh, and drive round Bangalore

The charge for the above trip will be Rs. 5 per head.

OUTSTATION TOURS

The following outstation tours have been arranged. Delegates are requested to select one, out of them. As the number of delegates that can be accommodated in each tour is limited, the allocation of tours for the delegates will be according to priority of registration. Registration will be made only on receipt of full payment. Delegates will have to bring their own bedding for all the tours.

Tour No. 1(a)

February 7, 1963	Leave Bangalore for Bhadravati, reaching Bhadravati at 12.30 p.m. Lunch at Bhadravati. Visit Bhadra Reservoir Project and return to Bhadravati and halt for the night.
February 8, 1963	Visit to Mysore Iron and Steel Works and Paper Mills Halt for the night at Bhadravati.
February 9, 1963	Leave for Jog at 7.00 a.m. Visit Linganamukki and Talakalale Dams and Generating Station site. Lunch in the afternoon. Dinner at Jog and rest for the night at Jog.
February 10, 1963	Leave for Bangalore at 8.00 a.m. Lunch at Arsikere Reach Bangalore by 5.00 p.m.

Tour No. 1(b)

February 7, 1963	Leave Bangalore at 7.00 a.m. for Jog, reaching Jog at 5.00 p.m. Rest for the night.

February 8, 1963	Visit to Linganamukki and Talakalale Dams and Generating Station site. Lunch in the afternoon. Dinner at Jog. Rest for the night.
February 9, 1963	Leave for Bhadravati at 7 a.m. Visit to Mysore Iron and Steel Works and Paper Mills between 2 p.m. and 5 p.m. Rest for the night.
February 10, 1963	Leave for Bhadra Reservoir at 8 a.m. Inspect Bhadra Reservoir. Lunch at Arsikere. Reach Bangalore at 5 p.m.

Tour No. 2

February 7, 1963	Leave Bangalore at 7 a.m. for Tungabhadra. Lunch at Marikanive and reach Tungabhadra. Rest for the night.
February 8, 1963	Visit to Tungabhadra Steel Products between 8 and 10 a.m. Visit to Humpi between 1 and 5 p.m. Return to Munirabad at 6 p.m. and visit Tungabhadra Dam. Rest for the night.
February 9, 1963	Leave Munirabad at 8 a.m. for Harihar, reaching Harihar at 10.30 a.m. Visit to Mysore Kirloskars ; Lunch at Kirloskars at 12.30 p.m. Leave Harihar and reach Bangalore by 7 p.m

Tour No. 3

February 7, 1963	Leave for Shimsha at 7 a.m. Lunch at Shimsha. Leave for Bandipur, visiting Somanathapura on the way. Dinner and rest at night at Bandipur.
February 8, 1963	Visit to Game Sanctuary between 6 and 9 a.m. Leave for Krishnarajasagar at 10 a.m. after Breakfast. Visit to Krishnarajasagar Research Station between 4.30 and 6.30 p.m. See Illuminations from 6.30 to 8 p.m. Dinner at Krishnarajasagar and leave for Mysore. Rest for the night at Mysore.
February 9, 1963	Visit to places of Interest in Mysore from 8 a.m. to 12 noon. Leave Mysore after Lunch, reaching Bangalore at 6 p.m.

Tour No. 4

February 7, 1963	Leave Bangalore for Mysore at 7 a.m. Visit to Srirangapatna on the way. Lunch at Mysore ; drive round Mysore. Leave for Krishnarajasagar at 4.30 p.m. Visit to Krishnarajasagar Research Station from 5 to 6.30 p.m. See Illuminations from 6.30 to 8 p.m. Dinner at Krishnarajasagar. Rest for the night at Mysore.

February 8, 1963	Leave Mysore for Belur at 7 a.m. Lunch at Belur. Visit to Belur and Halebid Temples. Halt for the night at Hassan.
February 9, 1963	Leave Hassan at 7 a.m. for Sravanabelagola. Proceed to Bangalore after Lunch at Marikanive, reaching Bangalore at 7 p.m.

Notes

1. **Registration fee**

Corporate Members and Graduates	...	Rs. 15.00 each
Students	...	Rs. 8.00 each

2. **Annual Dinner**

Corporate Members, Graduates and their Gentlemen Guests	...	Rs. 15.00 each
Students	..	Rs. 10.00 each.
Lady Guests	...	Rs. 10.00 each

3. **Visits**

Local	...	Rs. 5.00 per participant
Outstation	...	Rs. 90.00 per participant for one tour only

4. **Transportation**

A consolidated charge of Rs. 5.00 will be levied for each delegate availing the transportation arrangements made by the Mysore Centre during the Convention, exclusive of the charge for local visits. The above charge includes conveyance from railway station to place of lodging and from place of lodging to various meeting places, etc.

5. **Ladies' programme**

A separate programme for ladies accompanying members is being arranged and a charge of Rs. 10.00 will be collected from each lady accompanying a delegate and this will include all facilities arranged during the Annual Convention, including special tours arranged for ladies but excluding Annual Dinner, outstation tour and hotel charges.

6. **Arrangements for return journey**

Reservation for the return journey of the delegates will be arranged, if the exact date of departure to their places of destination is intimated sufficiently in advance. M/s. Thos. Cook & Son, 20-C, Mahatma Gandhi Road, Bangalore 1, are in charge of these arrangements. They will charge their usual service charge of Rs. 5.00 per ticket for this facility.

LADIES' PROGRAMME

February 2, 1963

9.00 a.m. to 1.00 p.m.	Registration and presentation of gifts and badges at Puttanna Chetty Hall
3.00 p.m. to 5.00 p.m.	Conducted shopping tour
6.30 p.m.	Tea

February 3, 1963	
9.00 a.m. to 11.00 a.m.	Inaugural Session
10.30 a.m.	Tea
11.00 a.m. to 1.00 p.m.	Visit to Cubbon Park and Lal Bagh
1.00 p.m.	Lunch
8.00 p.m.	Annual Dinner
February 4, 1963	
9.00 a.m.	Leave for Nandi Hills. Lunch at Nandi Hills and return to Bangalore by 5 p.m.
6.00 p.m.	At Home
6.45 p.m. to 8.00 p.m.	Cultural Show
February 5, 1963	
9.00 a.m.	Leave for Chamarajasagar Water Works; Lunch at Chamarajasagar Water Works
3.00 p.m.	Return to Bangalore
6.00 p.m.	Tea
6.45 to 8.00 p.m.	Cultural Show
February 6, 1963	
9.00 a.m. to 1.00 p.m.	Visit to Ladies Organizations at Bangalore
3.00 to 6.00 p.m.	Shopping
February 7, 1963	
7.00 a.m.	Leave for Outstation Tours

RAIL CONCESSION

The form for rail concession is attached at the end of this programme, Members attending the Convention and desirous of availing the concession are requested to fill in and return it in duplicate to the Secretary or the Honorary Secretary of their Local Centre.

As regards the rail concession, Members will please remember that :

(1) The concession is available for a to and fro journey by the shortest route between the railway station where the journey commences and Bangalore City/Bangalore Cantonment.

(2) The concession is available only to the Member's person, and cannot be extended to his lady or family.

(3) The Railway Board have authorized, as a special case, the Honorary Secretaries of the Local Centres, in addition to the Secretary of the Institution, to issue the Certificate.

(4) The Railway Board require that a Letter of Authority should first be obtained from an authorized Officer of the Railways, who is generally the Chief or District or Divisional Commercial Superin-

tendent, which should be produced to the Station Master of the Railway Station where the journey commences. *Members resident at small stations are particularly invited to note this, as the Station Masters themselves are not authorized to admit the concession.*

(5) The Railway Board require that the Institution should submit a statement after the Annual General Meeting, as to how many members availed themselves of the concession. **The continuance of the concession is dependant on the submission of this statement to the Board.** Members are, therefore, requested to (a) fill in the slip attached to the concession form and return it to the Head Quarters after the Annual General Meeting; and also (b) to state if they availed of the concession in the special column which will be provided by the Mysore Centre in the Registration books at Bangalore. **These two requirements are most important.**

GRANT OF CASUAL LEAVE FOR GOVERNMENT OFFICERS ATTENDING MEETINGS OF SCIENTIFIC ASSOCIATIONS

An extract from Notifications No. 74(4)/-50-SR.III dated July 29, 1951, printed in the *Bulletin*, vol. 1, no. 1, September 1961, p. 28, and No. 27(7)/53 -SR.III dated December 10, 1953, printed in the *Bulletin*, vol. 3, no. 3, March 1954, p. 14, issued by the Ministry of National Resources and Scientific Research, Government of India, in regard to the grant of casual leave to such officers as desire to attend meetings of scientific associations is reproduced below for information :

'.....................subject to the exigencies of Government business, Government servants who are invitees, members, official delegates of the organization concerned or have been asked to read papers at a conference may be given facilities to attend meetings organized by scientific associations like the Indian Science Congress Association, The National Institute of Sciences of India, The Institution of Engineers (India), The Indian Academy of Sciences, Bangalore, and other similar bodies, by the grant to them of special casual leave to the extent required for attendance at the meetings and for journeys to and from the places of meeting. It is requested that if there is no objection, requests from individual Government servants for leave to attend meetings of scientific associations may be disposed off in the light of this decision'.

THE INSTITUTION OF ENGINEERS (INDIA)
8 Gokhale Road, Calcutta 20

Subject: Rail concession to delegates attending the 43rd Annual General Meeting at Bangalore in February 1963

Railway Board Ref.: Appendix P/XXII-A [see Rule 118, Serial No. 18(1) & (2)]

Certificate Form

It is certified that Shri/Shrimati..........................is a person travelling from................to Bangalore to attend the 43rd Annual General Meeting at Bangalore on February 2-9, 1963, and is entitled to the concession of return tickets in any class available for one month on payment of single fares, mail fares being charged for second and third classes.

(i) He/She is a servant of the Central/State Government/local body or a Statutory authority.

(ii) He/She is not a servant of the Central/State Government/local body or a Statutory authority.

(iii) His/Her travelling expenses will not be borne by the Central/State Government/local body or a Statutory authority.

Secretary/Honorary Secretary *Centre*

Place....................

Date.....................

Please tear off here and return to the Secretary/Honorary Secretary, Mysore Centre

* I hereby certify that I am an employee of the Central/State Government/local body or a Statutory authority and that I shall not claim mileage allowance from the Central/State Government/local body or a Statutory authority for the journey performed on the concessional return ticket.

Signature......................................

Place.................... Designation..................................

Date.................... Office address.................................

....

**Note*: 1. This certificate must invariably be filled in by employees of Central/State Government/local body or a Statutory authority.

2. Government servants, etc., whose travelling expenses are borne by the Central/State Government/local body or a Statutory authority either wholly or even partly are not entitled to this concession and it is his/her responsibility not to claim this concession. Any breach of this rule by the Government servant will render him/her liable to disciplinary action.

Keep this with you till after the Annual General Meeting, and then return it to the Headquarters.

I availed of the rail concession* given by the Railway Board for members of the Institution attending its Annual General Meetings, and travelled on this concession from....................to Bangalore and back from Bangalore to....................

Name of delegate ....

Signature..

THE ENGINEER AND SOCIETY*

Dr. M. S. Thacker

Member

'I deem it a great privilege to be called upon to deliver this lecture, established by the Institution of Engineers (India), in honour of Dr. Mokshagundam Visvesvaraya. Visvesvaraya's has been a rich and eventful life and success has come to him in a measure that is given to few. His many-sided genius as engineer, educationist, statesman and champion of industrialization has obtained wide recognition. Governments, Universities and professional bodies have showered honours on him and independent India has conferred on him the highest honour of all, the *Bharat Ratna.*

The subject of my address, is, in a way, the Engineer and the Society, tracing in a general way important landmarks in the history of engineering and technology and referring to some of the complex interactions between technological advance and social conditions from the earliest times to the present day. I may define technology as the science and art of manipulating the sources of power and materials available in nature, modifying them where necessary and utilizing them for the manifold purposes of man. In this broad sense, technology includes engineering and extends over the entire field of what we call 'applied science.' And in the history of the world, in all ages and in all countries, the engineer has played a decisive role in shaping the lives and activities of men.

May I go back to trace the history of the development of technology—or, as we may call it, 'engineering'. During the Palaeolithic or Old Stone Age, which began 500,000 years ago, man learnt to make tools from stone, bone, horn and wood. At first, he picked up and made use of suitable natural objects but gradually elaborated skilled techniques for working them and evolved a number of specialized tools like the axe, knife, saw, scraper, needle, spear and harpoon. He also used two important machines, the bow and the spear-thrower. The bow was the first machine for storing energy.

The Palaeolithic Age continued up to about 12,000 years ago and accounts for 98% of the period of man's existence on earth. In the ensuing Mesolithic or Middle Stone Age, fishing tackle and some refined carpenter's tools were invented. The sled and the dugout canoe with paddles were developed for transport by land and water.

During all this immense stretch of time, there was no basic change in man's way of living. He remained a hunter, a food-gatherer, with no fixed habitation, following game where it moved. Food procured by great effort and ingenuity was barely adequate. And human communities were small, to be counted in tens or hundreds at the most.

The Neolithic or New Stone Age began about 8,000 years ago and owes its name to the emergence of new, ground and polished stone tools of greater refinement. The domenstication of plants and animals in the early Neolithic Age brought about a major revolution in human life. With the practice of agriculture, man became a producer of food instead of being merely a hunter and gatherer. A fundamentally new mode of life now became possible and produced a spate of inventions during the two millennia preceding 3,000 B.C.

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* Text of the Fifth Sir M. Visvesvaraya Lecture, delivered at the 42nd Annual Convention, Calcutta, February 4, 1962.

Agriculture made settled living necessary and gave rise to villages. At the same time, it stimulated the invention of special appliances—the hoe, the plough and the sickle. The flail was invented for threshing grain and the quern for grinding it. Pottery arose in response to the need for vessels to store and cook grain.

The Palaeolithic hunter covered himself with the skins of the animals he killed. The Neolithic farmer learnt to make textiles from various fibres—flax, wool, linen and cotton—and invented two new machines, the spindle and the loom.

The new mode of living became established first in the valleys of the Euphrates-Tigris, the Nile and the Indus where the annual flooding of the rivers renewed the fertility of the soil. Rivers were also used for water transport which was soon revolutionized by the invention of the sailing boat. The sail is the first instance of the use of inanimate energy for motive power.

The invention of the wheel is an application of true rotary motion. The potter's wheel led to large scale production of pottery. Combined with the invention of the harness for oxen, the wheel initiated a revolution in land transport. All subsequent advances in communication up to the jet engine—steamship, railway, automobile, aeroplane—have been dependent on rotary motion. And, rotating machines driven by water, steam or electricity were among the crucial fctors of the Industrial Revolution.

From very early times, a number of copper ores had been used as charms or pigments on account of their bright and striking colours. The discovery that these could be reduced to metallic copper by heating with charcoal was one of fundamental significance. Once the metallurgical processes were mastered, tools and weapons of copper proved immensely superior to those of the traditional materials—stone, bone and wood.

The metallurgy of copper was followed by that of silver, lead and tin. It was found that casting is easier and the product more durable if copper is alloyed with other metals, particularly tin. Bronze came into use in India, Mesopotamia, Asia Minor and Greece by about 3,000 B.C. and the next two millennia until the advent of iron remained as the Bronze Age.

Life in settled communities naturally encouraged the art of building and the original dwellings of mud, reeds and thatch gradually gave place to structures of brick, wood and stone.

The flood of inventions that followed in the wake of the transition from a hunting to an agricultural economy gave rise to a number of specialized occupations such as carpentry, pottery, boat-making, spinning, weaving, building, and metallurgy which was the most specialized of all. However, the full exploitation and wide diffusion of the new techniques required a new type of social organization which was developed in the cities that arose in the river valleys of the Fertile Crescent and the Indus region by about the beginning of the third millennium B.C. These cities grew into flourishing centres of civilization.

Planning of cities, building of houses, temples, palaces, provision of water supply and sanitation, and the construction of canals for irrigation and transport, stimulated the development of structural and hydraulic engineering. Techniques of metallurgy, boat-building, chariot-making also greatly improved.

However, the increase of production that resulted from these developments did not bring any prosperity to the craftsmen and labourers who were the real producers of wealth. The surplus was appropriated by the State, by the King and his supporters. The peasants and the workers were progressively reduced to a state of serfdom and slavery and forced to live miserably at the level of bare subsistance. The art of writing was the monopoly of priests and accentuated the divorce of learning from craftsmanship. Such a state of affairs was hardly conducive to innovation and the Bronze Age produced few basic advances in engineering and technology.

Meanwhile the rulers lived in glittering splendour and built on a grandiose scale. The size, beauty and technical excellence of these structures justly evoke our admiration, particularly in view of the limited mechanical aids available at the time. Thus, the Egyptians used only the lever, the inclined plane and the wedge in building the pyramids and yet succeeded in incorporating huge blocks of stone in building an enormous structure of almost perfect geometrical design. And yet, we must not forget the immense expenditure of manpower; Herodotus tells us that a hundred thousand men were employed during three months each year for 20 years in building the Great Pyramid. In fact, it was the merciless exploitation of human slave labour that prevented the development of other sources of power for almost three millennia.

The contradictions inherent in the river valley civilizations of the Bronze Age led to technological stagnation and decline; and the civilizations readily succumbed to barbarian invaders from the north, equipped with weapons of a new metal, iron. Though iron ores are abundant and widely distributed, the metallurgy of iron is complex and unlike that of copper. The smelting of iron on an appreciable scale was first achieved by an Armenian tribe in the fifteenth century B.C. but the Iron Age really began only some three centuries later when the use of the metal had spread to other areas.

On account of its cost and comparative rarity, bronze had all along been available only to a privileged few or for special uses as in warfare. Once the technique of iron making was mastered, metal tools and weapons became available in far greater measure than hitherto and led to profound social and technological developments.

The new Iron Age civilizations took root in India, Persia and Greece, on the outskirts of the older centres which they overran. Though the early part of the Age did not bring forth any great inventiveness, a few developments are worthy of mention, among which the pulley is perhaps the most important. Another is the rotary quern for grinding corn.

In these various ways, the onset of the Iron Age enhanced the productive capacity of mankind. Goods became available in far greater measure than in the previous Age and more people could aspire to a higher standard of living. Yet the widespread prevalance of slavery remained a bar to technological progress. Among the early civilizations of the Iron Age, the Greek was of the greatest significance to the subsequent history of mankind.

The Greek civilization is noted for its brilliant achievements in art, philosophy, literature and science, and attained its highest development in Athens in the fifth century B.C. The Greeks were the first people in antiquity to attempt to understand nature and originated science, but the division of society into citizens and slaves prevented them from applying science to engineering and technology. Science was held to be a mental exercise fit for free men.

After the death of Alexander and the break-up of his empire, Greek culture passed on to Egypt and the next few centuries brought some advances in engineering. Archimedes is credited with the invention of the screw pump which was used for irrigation and pumping water from mines and ships. He also developed the theory of the lever and founded the science of theoretical mechanics. He constructed several ingennious military machines but seems to have been ashamed of putting his genius to practical use. The same attitude prevented the application of the force pump invented by Ctsibius. Hero of Alexandria constructed gadgets incorporating the principle of the windmill and the steam engine. Though these could have been developed into effective prime movers, they remained mere mechanical toys as did various other devices constructed by others during this period. So long as slaves were available to do the work, there was no pressing need to harness natural power.

The Romans were the greatest builders of antiquity, and their roads, bridges and aqueducts extended all over their far-flung empire. Some of these are still in use today. Roman cities had elaborate arrangements for water supply and sanitation, which were not equalled in Europe until quite recent times. They learnt to make concrete from sand, lime, stone and water and established construction techniques which persisted until the advent of modern machinery. In architecture, they used the vault, the dome and above all the arch. Most of their technical knowledge was, however, obtained from the Greeks, and the Romans contributed little that was original or fundamental.

With the waning of Roman power, slavery began to decline and feudalism arose in Europe during the Middle Ages. Non-human sources of power now began to be exploited on an increasing scale. The water wheel was invented in the East, probably in India, early in the first century B.C. and was known to the Romans soon after, but little use was made of water power until the fourth and fifth centuries A.D. when Roman power had declined and the paucity of slaves had resulted in serious labour shortages. Water power was used for several centuries almost exclusively for corn grinding but its use gradually extended for other purposes like fulling of cloth, sawing wood, metal forging and pumping mines. The use of water power to blow a blast of air and thus attain a higher temperature made the production of cast iron possible. Blast furnaces were erected in the fourteenth and fifteenth centuries.

Another source of power became available when the windmill was introduced into Europe from Persia in the twelfth century. The wide use of animal power for transport and driving machinery became feasible when an efficient horse-harness was introduced from China in the tenth century. Other significant inventions also came to Europe from China—the rudder, the compass, gunpowder, paper and printing. The rudder and the mariner's compass came into use in the twelfth century and radically improved navigation and extended the limits of trade. Gun powder revolutionized warfare and was instrumental in the break-up of feudal power. The effects of printing on the diffusion of learning paved the way for the Renaissance.

Towards the end of the Middle Ages, technological supremacy was shifting from the East to the West. And the Renaissance accelerated the process by breaking down the shackles of tradition. A new spirit of enquiry and adventure was in the air. Classical learning was studied and assimilated and soon began to be questioned. Experiment and observation were established as the only means of gaining a knowledge of nature. Modern science was born and a greater interest in mechanical appliances brought learning and technology together in a mutually fertilizing liaison.

At the same time as man's mental horizons were being extended, spatial frontiers were also receding. Building of better and bigger ships and the improvement of navigation had made possible the great voyages of Columbus, Magellan and Vasco da Gama, who brought knowledge of new lands and established sea routes for trade and, later, conquest. The era of capitalism and imperial expansion had begun.

By the end of the seventeeth century, industrial production in factories had made considerable progress in Europe, particularly in England. Mining and metallurgy had made great strides. Animal power, the water wheel and the windmill were exploited to a large extent but one serious problem remained. Mines were becoming deeper and the pumping of water was proving more and more difficult. The steam engine was invented to solve this difficulty but soon brought about profound changes which inaugurated the Industrial Revolution in the latter half of the eighteenth century.

The early engines of Savery and Newcomen worked but were inefficient. It was said that the steam engine required an iron mine to make it and a coal mine to run it. However, improvements were soon made and in the hands of Watt, the steam engine became a really efficient prime mover which was mobile and thus free from the disadvantages—undependability and fixity of location—of wind and water.

At about the same time, several important inventions were made in the spinning and weaving industry. The exploitation of these with the newly found power of steam rapidly brought Britain to the forefront in the manufacture of textiles.

About the same time, several important inventions were made in the spinning and weaving industry. The exploitation of these with the newly found power of steam rapidly brought Britain to the forefront in the manufacture of textiles.

The Industrial Revolution raised the productive capacity of mankind to a level undreamt of ever before. The mass production of goods brought them within the reach of all and not merely of a privileged few. But its immediate effects were not an unmixed blessing. Women and children came to be employed in factories and made to work too long under appalling conditions for a miserable wage. However, the very fact of working together led to the emergence of a labour class which became increasingly conscious of its common interests and united to secure them. This and the pressure of social reformers gradually brought progressive improvement in their condition.

The discovery of electromagnetic induction by Faraday in 1831 laid the foundations of the electrical industries which have attained immense proportions today. The water turbine has made possible the generation of electricity by the power of moving water. The applications of electricity in the telegraph and the telephone, the electric motor and electric lighting in the factory, the office and the home have transformed life during the present century.

The discovery of atomic energy in our time is comparable in its potentialities to that of agriculture or metallurgy, though its first use was for destructive purposes. The effective harnessing of atomic energy for power demands engineering and technology of the highest order and not all of the attendant problems are solved yet. A major problem is to find a practicable method for the direct conversion of heat into electricity.

Electronics engineering has fostered automation and brought the completely automatic factory within the realm of practicability in the near future. The almost unlimited power made available by atomic energy, and the release from monotonous and exhausting toil that automation promises, hold forth the prospect of an immense improvement of the material welfare of mankind.

Several new materials have had important effects on engineering and technology. Plastics and other synthetic materials are available for almost any purpose with almost any specified properties. Developments in the field of light alloys and special steels are taxing to the utmost the ingenuity of engineers and technologists. Reinforced concrete and now prestressed concrete have revolutionized building practice.

Today, the phenomenal increase in the range and speed of communication by radio and aeroplane has virtually annihilated time and distance and enhanced contacts between peoples. With the end of colonialism, the newly independent nations of the world are undergoing what has been termed 'a revolution of rising expectations'. Many of them have launched ambitious plans for industrialization with a view to economic development and improvement of living standards.

I am sorry if I have inflicted on you rather a long matter-of-fact account of the growth of technology from the pre-historic times. I have attempted to show that right from the ages past, growth of technology and the streams of civilization have mutually interacted, often times for good but not always so. Social conditions have, in many instances, hampered technological growth and similarly, important landmarks of technology have adversely affected society.

Coming to our own days, we have heard it often said by eminent men that modern technological developments are not an unmixed blessing. Partly, all of us will agree with this point of view. Several examples could be cited to show how developments in technology have not added to human happiness in an unadulterated manner. The pessimist can take the view that some of these developments have, on the contrary, brought in untold misery to man, It is in this context that I consider that scientists, technologists and engineers have an important contribution to make. Should they be merely carrying out the behests of those who are in power and position; should they not contribute in a more positive manner to the shaping of ideas and events which may in the long run orient and strengthen the constructive forces? If we accept the thesis that technology has great influence in the shaping of civilization—I know all of you will accept this thesis—then, it is incumbent on you to see that the various forces which are having their play in this world are directed towards constructive purposes.

If scientists, technologists and engineers could rise above mundane and personal considerations and deal with these problems in an objective and constructive manner, I am sure they could make a great contribution to the welfare of mankind. We should be thankful to Providence that in India today scientists, technologists and engineers have a wonderful opportunity to play such an effective role.

Planning has come to stay in India; we have already successfully completed two Five Year Plans and are embarked on the third. The achievement of the objectives of these and of such subsequent plans will depend in a large measure on the devotion, efficiency and initiative which our engineers show in their allotted tasks, and they shall have to be equipped with the latest knowledge and trained in the most modern methods in their field.

May I end: sixteen times a day, a man-made satellite can circumnavigate the earth. *Homo Sapien*, the earthling, has shrunk his world to the dimensions of a very small planet. Scientists and engineers have outdone the ancients, who in the arrogance of their material success built pyramids as the gravestones of their civilizations, but modern man can throw his pyramids into space and they may orbit eternally round this planet. Will the modern scientist and engineer choose to use his science and wisdom and cooperate with all his kind in the noble task of enrichment of the people?'

ADDRESSES OF CHAIRMEN AT THE ANNUAL GENERAL MEETINGS OF THE LOCAL CENTRES

Kerala Centre

Chairman's address by Shri C. S. Padmanabha Aiyar, M.I.E., at the 15th Annual General Meeting of the Centre held on January 6, 1962

The Chairman welcomed the Chief Guest and other invitees, and thanked the Committee of the centre for electing him Chairman for the year 1961-62.

In his address, Shri Padmanabha Aiyar briefly dealt with the development of roads and communication systems in Kerala State in the following words: 'The total area of the State is 15,000 sq. miles. Within the narrow belt of an average width of 43 miles lying between the Arabian Sea and the Western Ghats, the ground levels vary from 0 to 8,000 ft. above the sea level. The average density of population is 1,125 per sq. mile which is the highest in India. The population is generally spread over the entire occupied area instead of being concentrated in villages and towns, leaving wide open spaces between. The railroad communication (209 miles of metre gauge and 335 miles of broad gauge) traverses longitudinally along the coast with only two cross-connections crossing the Western Ghats. The navigable waterways which extend to about 285 miles are also generally along the coastal route. Thus, the railways and the waterways serve almost the same belt of land near the coast. Therefore, roads are the mainstay for communication over the major portion of the populated area, so construction and development of roads assumes considerable importance in this State.

The three regions comprising the Kerala State, *viz.*, Travancore, Cochin and Malabar, were under different administrations till their integration in 1949 and 1956. Different policies were pursued in the matter of road development in the three regions. The Travancore and Cochin administrations followed a liberal policy of road development, setting apart a sizeable portion of the State's revenue for this purpose. In the Malabar area, however, most of the roads were under the District Board which, on account of lack of resources, could not attempt large scale development. As a result, there was considerable disparity in the matter of road development in the Travancore-Cochin and Malabar areas. At the time of the reorganization of States, the former had about 7,500 miles of road, while the latter had about 3,200 miles. In terms of miles of road per 100 sq. miles of area, the respective figures were about 84 for the Travancore-Cochin region and 44 for the Malabar region. A part of the Travancore-Cochin area was added to Madras State so that there was a total of 9,500 miles of roads, *i.e.*, about 63 miles per 100 sq. miles. Although this appears high when viewed against the all-India figure, it is still insufficient to meet the demands.

During the Second Plan, about 400 miles of new roads were added to the system, which included 235 miles of village roads. Thus, at the end of the Second Plan, there was a total of 9,927 miles of roads as under:

National highways	..	280 miles
State highways	..	1,218 miles

District roads	.. 3,843 miles
Village roads	.. 4,586 miles

Based on the type of surface, the mileages of respective categories were:

Concrete roads	.. 70 miles
Black-topped roads	.. 1,625 miles
Metalled roads	.. 2,800 miles
Earth, gravel, roads, etc.	.. 4,732 miles

Thus, nearly one-half of the roads have metalled surface or special surface such as bitumen or concrete.

In 1958, the Chief Engineers of all the States studied the transport needs of the country and prepared a comprehensive plan for development of roads to cover the two decades from 1961-1981. Certain formulæ were evolved for working out the required lengths of road of different categories. According to the formulæ devised by them, this State should have in 1981 a total of 10,057 miles as under:

National highways	.. 400 miles
State highways	.. 350 miles
District roads	.. 5,807 miles
Village roads	.. 3,500 miles

The difficulties experienced in getting access to villages indicate that this formula needs modification to suit the topography and pattern of settlement. Even now there is a large mileage cart track which has to be developed at least to the standard of village roads. About 24,000 vehicles ply on the roads, with about 300 major routes over which passenger buses ply. There is considerable demand for extending the bus routes and opening new routes. All these point to the need for further extension of roads and improvement of the existing roads.

It has been proved by experience in various countries that the cost of operation of goods vehicles is reduced when heavier payloads are allowed. The Indian Productivity Team on Road Transport have pointed out: 'As against a gross laden weight of 8 to 12 tons permitted for trucks in India, which enables vehicles to carry a payload of 5 to 8 tons, the gross weight allowed for combinations in the U.S.A. and Germany is 32 tons, *i.e.*, a payload of as much as 25 tons can be carried. Semi-trailers or articulated trailers which are extensively used in the U.K. and the U.S.A. usually carry 17 to 21 tons of consignment.

The use of these combinations has cut road transport costs by as much as 77% in the past two decades. Taking the 6-ton lorry now in use in India as the standard, the operating cost can be reduced by 40% with a 13½-ton unit, 47% with a 18-ton unit, 66%, with a 22½-ton combination, 72% with a combination carrying 27 tons and 77% with a unit carrying 32 tons. It is these combinations that constitute the backbone of road transport productivity in the West.

We can hardly ignore the modern trend in road transport development and must make our roads to take heavier vehicles or combinations of vehicles and at increased speeds. This necessitates upgrading and improvement of the roads and bridges.

The National Highways should be all-weather roads with a land width of 150 ft. in open agricultural areas and 80 ft. in built-up areas, having 40 ft. formation width, with a black-topped or concrete pavement for two-lane carriageway. All our streams should be bridged with bridges capable of taking two lanes of class A loading or a single-lane of class A loading under the I.R.C. Standards. In Kerala, the standards of width have been somewhat reduced in view of the heavily built-up nature of the State. The total cost of developing the National Highways in the State to the standards required will be about Rs. 9 crores, of which about Rs. 4 crores will be required for providing the formation and a dual carriageway. The balance of Rs. 5 crores is required for meeting the cost of 23 major bridges and by-passes around major municipal areas. So far, about 45 miles of widening and eight bridges have been completed. Two bridges are under construction and 13 more are to be taken up. Although considerable amount of work still remains to be done, lack of funds and delays and difficulties in acquiring land for widening, etc. have hampered the progress.

Next in importance to the National Highways are the State Highways. The West Coast Road is intended to provide a through road connecting the towns on the west coast of the peninsula from Bombay towards south and ultimately link up with Chalisseri on National Highway 47A. The length of this road in this State is about 198 long. The Government of India have agreed to bear the cost of construction and improvement of this road to take a single-lane paved roadway with somewhat a lesser standard than National Highways. This work is in progress, four major bridges are under construction, and work on five more is expected to start shortly. Reconstruction of five existing bridges is subject to availability of funds.

Apart from the West Coast Road, we have about 1,000 miles of State Highways. A recent traffic census has shown that most of these carry loads varying from 1,500 to 3,000 tons per day, with a heavier intensity of traffic near municipal towns and industrial areas. Such loading is classified 'very heavy' according to I.R.C. classification, and the existing 12 ft. and 14 ft. width of pavement is inadequate for this load. Furthermore, the roads are narrow for the traffic to be catered for, and have sharp curves and steep grades. Thus, there is need for improving the geometry of the roads besides providing a dual carriageway to enable vehicles moving in opposite directions to pass each other at reasonable speed with safety. Nearly Rs. 12 crores may be needed for such improvements. Considering the rapid traffic development and the fact that postponement will make it costlier on account of ribbon development and increased cost of acquisition, this work must have a high priority.

Our district roads also carry heavy traffic. A large portion of these roads in the Malabar area has latorite surface only and this is inadequate to withstand the traffic. Upgrading and improvement of these roads are being taken up.

As regards village roads, new roads may be generally developed by voluntary contribution by the beneficiaries. In certain developed areas, such contribution is readily forthcoming, while in backward areas, there are some difficulties.

It is unfortunate that road development is assigned a comparatively low priority in the Plan schemes. The allocation for roads was Rs. 156 crores out of a total of Rs. 3,300 crores in the First Plan, *i.e.*, 4.6%. In the Second Plan, this dropped to 3.7%. Finally, in the Third Plan, the allotment was only 2.5% originally. In this State, the allotment for roads and bridges is Rs. 9 crores as against a total of Rs. 170 crores. No amount is available for new works, but the public demand for these is increasing. This has created a very difficult situation and no planned development is possible. In this connection, I suggest that a portion of the receipts under motor vehicles taxation may be set apart for improvement of State Highways. The annual revenue from this source is about Rs. 2.4 crores which is bound to increase every year. Most of the heavy vehicles are now using Diesel oil as fuel. This is not taxed to the same extent as petrol, and a small increase in tax on this commodity can supply a part of the finance needed to improve roads.

A serious defect in our road system is narrowness. This is partly due to the lack of development of roads but more often to haphazard growth of houses and buildings on both sides, technically termed 'ribbon development'. Steps have to be taken to prevent this through appropriate legislation. Another evil that is being felt increasingly is the encroachment into roads. Pressure of increasing population has been to a large measure responsible for this but the consequences of allowing this to go unchecked will be disastrous.

I have so far dealt with the development of roads only. We have a number of bridges also to be constructed. Many of our old bridges have either become weak or are inadequate for the present day traffic. About 700 bridges require reconstruction and many more have to be newly built.

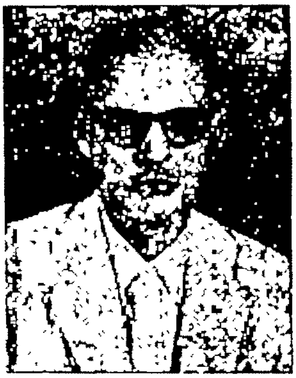
Our needs under this sector of development are great and pressing and the resources extremely limited. It is therefore necessary that every rupee spent is used in the best manner possible to give the maximum result. This is possible only if every engineer employed in such works puts forth his best effort so as to reduce the cost of construction and improve the efficiency. This is true not only with regard to road development but development in other sectors also. In the implementation of the several schemes we have taken upon, there is a challenge and an opportunity. I am sure, we engineers, will face this challenge and by hard work and creative thinking justify the trust the country has placed in us.'

Nagpur Centre

Chairman's address by Shri Y. K. Ghanekar, M.I.E., at the 15th Annual General Meeting of the Centre held on December 16, 1961

The Chairman welcomed the Chief Guest, Shri S. G. Barve, Chairman, Maharashtra State Irrigation Commission, and other invitees and thanked the Committee for electing him Chairman for the year 1961-62.

Delivering his address, Shri Ghanekar spoke on some aspects of city improvement and development in the following words :



'Urban population is increasing by leaps and bounds. The ratio of urban to total population of India has increased to about 22 from 10.55 in 1931. Towns and cities are growing on account of influx from villages, due to the possibilities of better facilities of employment, education and amenities of life. Industrial development has been the major factor in attracting rural people, as industries provide better opportunities of employment. The result is more strain on the already inadequate housing, water supply and sanitation arrangements, aggravating the slum conditions.

Before embarking upon the improvement of the parts of a city or extensions by developing new areas around it, it is necessary to take up the preparation of a master plan for the city to have a complete picture of how the city will grow during the next three or four decades. Civic and physical surveys are needed to know the present conditions and future requirements for planning and development. The developments according to the master plan and the future trends can be studied and suitable modifications suggested. The master plan has to be based on town planning principles. It is a comprehensive plan for the physical development of the city and its environs. It must indicate the main lines of communication, and the location and character of different zones, showing land-use planning.

A master plan for the city of Nagpur has been prepared by the Nagpur Improvement Trust. The State Town Planning Department is preparing plans for other towns. In 1961, some villages in Vidarbha were affected by unprecedented floods. The department has, therefore, prepared plans for shifting these villages to higher and safer sites. The villages will serve as models in the planning and construction of houses with provision of public sites and amenities.

The Nagpur Corporation's scheme for augmentation of Kanhan water supply is nearing completion, and the first stage of the underground drainage scheme for the city is also nearing completion. Nagpur, will have a complete sewerage system. The State Government is executing water supply schemes for a number of towns in Vidarbha region, and projects for many other towns are in progress. It is expected that this work will be intensified in the Third Plan. Rural electrification has been undertaken on a wide scale by the Maharashtra State Electricity Board, but the demand for power is outstripping the supply.

The work of town planning and city improvement is one of promoting the health and happiness of the citizens. The environments have to be improved keeping in view the health aspect in relation to light, ventilation, height of buildings, density of population, etc. Medical aid and immunization from communicable diseases are palliatives with temporary effect, while improvement of environment to improve the health standards and their beneficial effects are more or less permanent.

A city must have wide roads, adequate water supply, an efficient drainage system, good street lighting, well planned markets, houses, large parks and playgrounds, educational facilities, public buildings, factories and a proper and fast means of communications. If the road and transport systems are good, there will be no difficulty in the development of new areas around the city. Railways also play an important part in providing proper transport facilities, especially local trains from suburbs to the city.

For proper, effective and safe use of roads, it is essential that proper facilities are provided for quick and safe movement. Obstructions to the flow of traffic are created by slow and mixed fast and slow vehicles. These can be avoided by segregation, *i.e.*, by providing footpaths, local roads and auxiliary roads along the main road, dual carriageways for smooth flow of traffic in opposite directions, and properly designed traffic islands at the junctions of important roads. No city can develop without adequate potable water supply. Additional water is required if a flushing system is provided. Factories, mills, railways, etc., require large quantities of water. As they provide the means of employment and help the growth of cities, adequate water supply has to be ensured for such purposes.

Of equal importance is the underground drainage system with a proper sewage disposal. Health and living standards cannot be improved without proper sanitation. Every house must be connected to the sewerage system wherever possible, or to a septic tank with soakage pits. The sewage of the entire city should be collected at one or more points and disposed off by partial or full treatment. In India, there is shortage of water for irrigation, and we can profitably utilize sewage effluent for irrigation. Care has, however, to be taken that the workers in the field and the consumers of farm produce are protected from health hazards.

Housing determines the features of the town and its residents and their habits and modes of life. A house must have adequate accommodation with sufficient light, ventilation and other amenities. Good architectural features are an added advantage. Housing shortage is an acute problem in every city. New houses are not built to meet the requirements of the growing population, old houses require remodelling, and many houses outlive their economic and safe life and become unfit for human habitation.

The Government has been trying to encourage the work on housing for middle income groups, low income groups, backward class people, industrial workers, slum dwellers, and municipal and Government employees. Everyone has an urge to own a house. The low income group housing scheme has been very popular because of its long term loans at low rates of interest. Industrial housing, backward class housing and slum clearance schemes are subsidized by the Government to the extent of 25 to 50% together with long term loans. The Government thus tries to keep the rents low, so that the workers can live in better houses in well planned localities. The actual needs are however enormous, and have to be dealt with by long term planning.

As housing is an important aspect of a town, the Government, municipalities and housing corporations should build large number of houses as a part of integrated city development, not only for their employees but for other people as well.

Every city has slums and new slums are added due to large influx and non-availability of accommodation at rents within the means. Slum clearance and housing are intimately interconnected. Slums can be cleared or prevented with speedier land development, by making more plots available at reasonable prices and by encouraging construction of houses.

For proper city development, there must be control with regard to the use of land and buildings, and the types of buildings with respect to height and bulk, and set-backs and side margins. Industrial areas should, as far as possible, be away from residential areas, but within easy reach from them. Markets and commercial areas should be centrally located. As these are busy areas, parking facilities should be provided for various types of vehicles. Public, administrative and educational buildings should be located in large open areas, so that they give a pleasing view. Aesthetics plays an important part in city planning. Parks and playgrounds are necessary open spaces serve as the lungs of a city.'

Orissa Centre

Chairman's address by Shri S. S. Behera, M.I.E., at the 3rd Annual General Meeting of the Centre held on January 28, 1962

The Chairman welcomed the Chief Guest, Shri Biren Mitra, Deputy Chief Minister of Orissa, and other invitees, and thanked the Committee of the Centre for electing him Chairman for the year 1961-62.

Delivering his address, Shri Behera spoke on the problems of roads and road transport facing the country in general and Orissa in particular, in the following words, 'In an expanding economy like ours, it is imperative to develop all modes of traffic. The demand for transport has already increased to a large extent with the rapid industrialization and other developmental activities, and is being accelerated day-by-day. At present, the railways provide the means for bulk transport, but their capacity has reached the point of saturation on most of the lines. Further development is necessary by the construction of additional route mileage, doubling of lines, provision of better yard marshalling facilities, etc. It has been estimated that the total traffic to be moved by 1961 will be of the order of 185 to 190 million tons and the shortfall in the railway capacity may be as high as 20 to 25 million tons. A very great leeway has therefore to be made up in the road transport system so that it can attain its right place and take its full share of responsibility in building the nation.

The basic advantages of road transport have been recognized in the advanced countries of the world, with the result that road transport is being called upon to carry increased volume of traffic. In India, reliable figures are not available to indicate correctly the amount of goods traffic carried on roads. It would, however, be of interest to note that this is of the order of 10% of the total goods traffic. As against this, goods traffic carried by road transport in the U.S.A. is 20%, in the U.K. about 55%, and in Australia, about 52%. With the progress now being made, it is expected that road transport will have to share a far greater volume of traffic in years to come.

The basic requirements of any system of transport are speed and cheapness, and road transport fulfils both these requirements. The Masani Committee on Road Transport Reorganization have stated, 'The advantage of low rail freight is nullified in many cases by the slow speed of a railway wagon which covers only about 48 miles per day on an average, as against about 150 miles covered by a truck. This is the main reason why distributors of consumer goods, among others, prefer road transport even if the cost be somewhat higher. It is also argued that if the present restrictions on road transport are removed, bridges strengthened to carry economic loads, road surfaces modernized and truck-trailers and articulated vehicles permitted, road costs will be brought down materially ; and that, as a result, road transport, with the added advantage of speed, will be more economical to the consumer'.

The Chief Engineers of all the States, who were charged with the task of making recommendations for road development for 1961-81 came to the conclusion that at the end of 1980-81 the roads will be required to carry about 246,000,000 tons of goods traffic, *i.e.*, nearly 10 times of what they are carrying today. It has been estimated by them that the total expenditure on roads over this period will be of the order of Rs. 5,200 crores for development and Rs. 1,350 crores for maintenance. This will result in increase in mileage from 379,000 to 657,000 miles, giving a network of 52 miles of road per 100 sq. miles. With the implementation of this plan, it is expected that the revenue from motor transport taxation will be of the order of Rs. 6,150 crores, which means that the entire programme would be self-supporting. The objective of the plan is to bring every village in a developed and agricultural area within four miles, in a semi-agricultural area within eight miles, and in a non-agricultural area within 12 miles of a metalled road. It will thus be seen that even after implementation of this 20-year plan there still remains a long way to provide a road to each village.

For the overall development of our State, a well planned and adequate network of roads is essential. This is, however, lacking to a great extent. An all-weather road system requires the construction of a number of bridges across major streams. The State is crossed by eight major river systems besides a large number of streams, big and small. This has been the main bottleneck in attaining a satisfactory network of all-weather road system in the State. At present, there are unbridged gaps even in most of the arterial routes in the State. Further, most of the existing bridges and culverts are old and are not capable of taking the load of the present day heavy transport vehicles. If heavy vehicles including combinations have to be allowed to ply on these roads at optimum speed with safety, besides the bridging of gaps and reconstruction of old culverts and bridges, the roads will have to be widened and made stronger and smoother.

In 1948 the total length of roads of all categories was 4,888 miles, of which 2,155 miles were metalled.

During the First Plan, a sum of Rs. 187 lakhs was spent on roads. The results achieved were 30 miles of new roads, improvement to 781 miles of existing roads, construction of 16 major bridges, and partial construction of 21 bridges.

During the Second Plan, the total expenditure on roads was Rs. 539 lakhs, which was used for the construction of 20 miles of new roads, improvement of 1,000 miles of existing roads, completion of 28 major bridges, and partial completion of 16 bridges. The position of the roads at the end of the Second Five Year Plan stood as below.

Category	Mileage	Type of road surface		
		Black-topped	Metalled	Gravelled
National Highways	852	565	163	124
State Highways	1,389	704	489	196
Major district roads	2,924	458	1,289	1,177
Other district roads	1,131	79	237	815
Total	6,296	1,806	2,178	2,312

Besides the above roads which are under the control of P.W.D., other departments in the State, *viz.*, Revenue, Community Development, Forest and Tribal and Rural Welfare, also construct and maintain certain minor category of roads. But these are mostly fairweather roads with an earthen surface and a narrow formation.

The targets worked out from the modified Grid and Star formulæ for different categories of roads in the State, based on the recommendations of the Chief Engineers for the 20-year plan period are indicated in the table below.

Category	Mileage to be achieved by March 31, 1981	Mileage on March 31, 1961	Mileage to be achieved during the 20-year plan period
National Highways	1,116	852	264
State Highways	3,359	1,389	1,970
Major district roads	5,263	2,924	2,339
Other district roads	7,042	3,259	3,783
Total	16,780	8,424	8,356

From the above table, it will be seen that 8,356 miles have to be newly constructed or improved to the requisite standards. The approximate outlay for achieving this will be of the order of Rs. 200 crores. In view of the fact that these are vital for improving the general economy of the country, suitable ways and means will have to be found to secure the necessary resources for their successful implementation.

During the Third Plan period, the proposed outlay in the State sector is Rs. 7.5 crores, of which Rs. 75 lakhs are earmarked for improving some of the saline embankments for using them as roads. Out of the balance, the targets expected to be achieved are 30 miles of new roads and improvement to 900 miles of existing roads. Besides, work on 138 new major bridges will be taken up, of which 76 will be completed and others carried over to the Fourth Plan period. These targets fall far short of our actual requirements.

There is, however, a redeeming feature. It is a matter of gratification that besides the above plan schemes, two important major road projects have since been taken up for execution. The National Highway project at an estimated cost of Rs. 8.32 crores is being executed from a loan given by the International Development Association for the improvement of the National Highway No. 5 from Cuttack to Bihar border so as to provide all-weather communication between Cuttack and Calcutta. The total length of the road to be improved is 168 miles and it includes construction of nine major bridges besides reconstruction of almost all the existing minor bridges and culverts.

The other highway project connecting the Daitari-Tomka mining areas with the proposed port at Paradeep is estimated to cost Rs. 14 crores. The total length of this proposed highway is 92 miles, and involves the construction of major bridges over the rivers Brahmani, Badagenguti, Birupa, Nuna and Mahanadi. Some 30,000 ft. of viaduct are also required to be constructed to deal with the spills in the flooded areas, apart from a large number of minor bridges and culverts. This project will provide a direct short route link between the mining areas and the port for the main purpose of quick and economic transport of iron ore. Besides, the road will open up large tracts of flood affected areas which are otherwise completely cut off during the rainy season. The road will have a formation width of 40 ft. and a dual carriageway of 24 ft. width, with a road crust sufficiently thick to permit plying of modern heavy transport vehicles with combinations. Work on the project has commenced and the target date of its completion is June 1964.

It hardly needs emphasis that it is impossible to have proper development of the country without an adequate network of roads. The economy of the villages can be improved only if each village is made approachable by a road. With regard to the imperative necessity of roads for overall development of the country, I quote the words of our Prime Minister :

> 'I have come to the conclusion that one thing to which we must give topmost priority is roads ; roads of all kinds, not only very up-to-date, bituminized or cement roads, but roads of any kind to open out the vast areas of this country which are closed today and which cannot be reached unless you walk or ride. I give roads the first priority'.

Scientific knowledge in road construction has made very rapid developments in recent years. The concepts of today are being replaced by new concepts of tomorrow. This is the result of research into the techniques of road and bridge construction. Research work is a time consuming and continuous process, but it pays dividends in the long run by evolving cheap and improved methods of road construction by making the best use of the locally available materials. It is a matter of concern that our State does not yet have a road research laboratory. It is, however, heartening to mention that the Government have sanctioned a testing and control laboratory. The construction of the building will commence this year and is expected to be completed in about two years so that its advantage can be taken in the construction of the two major road projects which have since been embarked upon.

Coming to the implementation of the projects which has to be done timely and economically, it is the engineer on whom falls the responsibility and burden of planning, constructing and maintaining the road systems. I appeal to all our engineers to take it as a duty and devote themselves with a missionary zeal to implement their share of the Plan without allowing any delay. We have to streamline our organization so as to adjust ourselves with increased tempo, speed and efficiency. Delays have to be cut at all levels, and quality of construction coupled with economy and speed has to be maintained. In each project, a schedule programme has to be introduced and strictly adhered to by reviewing it periodically and removing in time any hurdles that come in the way of progress. Let us always bear in mind that we are the builders of today and that every one looks forward to us to build a new India. This is a big challenge and we all must rise to the occasion with determination to meet this challenge'.

Summaries of Papers Published in the Journal Vol. 43, no. 1, pts. CI 1, ME 1, & ET 1, September 1962*

CIVIL ENGINEERING DIVISION

Construction of New Double Track Gandak Bridge

Kalicharan
Associate Member

and

S. K. Mazumdar
Associate Member

In the year 1956, the Railway Board sanctioned the construction of a new double line metre gauge main line standard bridge over the Gandak River between Hajipur and Sonepore to eliminate the bottleneck caused by the restrictions on the old single line metre gauge bridge. This paper describes the works in connection with well sinking and construction of piers, and details of the girders, the assembly, and the launching, raising and widening of the spans.

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* These summaries were not published in September since the *Bulletin* had to be printed and posted within a scheduled date.

STRUCTURES GROUP 1—PRESTRESSED CONCRETE

Behaviour and Ultimate Strength of Prestressed Concrete Hollow Beams in Bending

Dr. Narayan Swamy

Associate Member

The paper summarizes the results of an investigation into the behaviour and ultimate strength of unbonded prestressed concrete hollow beams in bending. Eleven beams were tested post-tensioned on the Lee-McCall system. The amount of prestress and the size of the hollow were varied. A theoretical analysis covering both the elastic range and the plastic range is developed. The ultimate strength theory is based on Jensen's trapezoidal stress block. The agreement between the experimental and theoretical results is good both in the elastic and plastic ranges. The tests show that as in solid beams, the effects of prestressing is to raise the lower plastic limit, and increase the moment of first crack and the ultimate moment of hollow beams.

Secondary Stresses due to Prestressing in Fixed Arches and Portals

Prof. G. S. Pandit

Non-member

Due to the structural similarity of the fixed arch and the portal frame, a common expression can be developed for the secondary stresses in them due to prestressing. Fixed portal frames can be prestressed with advantage while the advantages obtained by prestressing a fixed arch are limited, specially for rolling loads. Komendant, Morice and Cooley and some other authors have given a general review of some typical works that have been completed. Fixed arches and rigid frames have to carry secondary stresses due to axial shortening which are absent in continuous beams with simple supports. Due to the complexity of the secondary stresses and their adverse effect on the strength of the structure, the structures are often so erected that they remain statically determinate till stressing operations are completed by provision of temporary hinges and special sliding devices and are subsequently made solid. However, if this cannot be done, the secondary stresses mut be calculated and allowed for. In large span arches and portal frames, the axial shortening may have very serious effects.

The article deals with the analysis of secondary stresses in fixed arches and portal frames. The strain energy equations have been used. Due to the freedom from cracking and greater homogeneity of prestressed structures as compared with conventional reinforced concrete structures, the use of elastic theory for calculation of secondary stresses at working loads is quite justified.

MECHANICAL ENGINEERING DIVISION

A New Electronic Drill Dynamometer

A. Ghosh
Non-member
S. C. Mukherjee
Non-member
and
A. Bhattacharyya
Associate Member

The paper describes the design, construction, calibration and performance of an electronic drilling dynamometer based on the principle of measurement of the time interval between two magneto-electric pulses generated by magnetic inserts in a non-magnetic disc rotating in a permanent magnetic field. Some test results obtained with the new dynamometer are presented and compared with available data given by other research workers.

Effect of Indicator Passage on the Correct Depiction of Indicator Diagrams

N. Srinivasa Murthy
Non-member

The electronic display unit like the cathode ray oscilloscope with a pressure-sensing element called 'pressure transducer' has established itself an instrument par excellence in engine indication work, especially when used on engines operating at high speeds. The fidelity of the indicator diagram to the pressure in the engine cylinder depends on several factors important among which are the transducer and its location.

The paper deals with the effect of the geometry of the passage connecting the combustion chamber with the transducer on the true depiction of indicator diagrams, and suggestions are given to get reliable and representative indicator diagrams.

ELECTRONICS & TELECOMMUNICATION ENGINEERING DIVISION

Three-Phase Transistorized Oscillator

A. B. Bhattacharyya
Non-member
and
S. K. Chattopadhyaya
Non-member

A symmetrical three-phase transistorized oscillator has been designed which is capable of generating single frequency oscillations. The frequency term of the oscillator

was derived by the matrix summation method. From the frequency term, it is possible to determine the self-capacitance of the transistor used. The oscillator has good waveform and stability.

Semiconductor Elements for Computers with Particular Reference to Logic Circuits

M. M. Mukherji
Associate Member

An attempt is made to make a review of the applications and suitability of semiconductor elements for electronic computers. A computer is interpreted for this purpose not only as a full fledged automatic digital computer and a powerful analogue differential analyzer, but, in addition, there are a large variety of applications where a group of circuit elements act essentially in a computer-like make performing logical functions like interlocking, sequencing, routing, etc., for which transistors are fast becoming rivals of the relay.

Design Charts for A.C. Servo *R-C* Lead Networks

I. J. Nagrath
Non-member

and

V. K. Arya
Non-member

One of the methods of compensating A.C. servos is to shape the frequency response of the servo amplifier. The commonly used networks for this purpose are *R-C* parallel-T and bridged-T. A sufficiently complete theory of A.C. networks is now available, but the exact expression for in-phase envelope transfer functions obtained from this theory are very unwieldy to be of much practical use in network design. It is possible to simplify the exact expression to yield an approximate transfer function by neglecting the higher order terms of data frequency. In this paper, design charts for A.C. lead networks in terms of the amplitude and the phase response of the network about the notch frequency are given.

Design of Bistable Multivibrator Using Saturated Transistors

V. V. Sarwate
Member

The conventional Eccles-Jordan flipflop circuit or bistable multivibrator can be easily converted into a transistorized version. There are two basic forms of transistor switches. In one type, the transistor is used as a current switch, and in the other as a voltage switch. The former can be regarded as a constant current generator where the current can be switched into the collector circuit in the 'on' position, and diverted from the collector circuit to some other circuit in the 'off' position. On the other hand, in the voltage switch, the collector voltage may be switched from a low value to almost the full value of the collector supply voltage. The advantage of the saturated switch lies in the fact that it gives the least collector dissipation, because in the 'on' position the collector current is large but the voltage is almost zero, while in the 'off' position, the voltage is high but the current is small.

Accuracy of Trajectory Tracing by Circle Method

C. S. Upadhyay
Non-member

It is shown in this paper that step-by-step trajectory tracing in electrostatic fields by the 'circle method' employing the trajectory tracing machine developed by Gabor and Halloway does not yield correct values for 'position' and 'slope' after each step of the traced trajectory. It is proved that if the curvature of the trajectory is calculated at the centre of each step as it is usually done, an error occurs in the position of the ray traced although its slope is obtained correctly. The position of the ray traced after each step can be obtained correctly if the curvature of the trajectory is calculated at one-third of the step instead of at the centre of the step. However, in that case, the slope is not correctly obtained. The magnitude of error involved in each case is calculated. Finally, it is established that correct position and slope after each step can be obtained by calculating the curvature at two-thirds of the step and adding a correcting term to the slope in each step. This correcting term has also been calculated.

Vol. 43, no. 2, pts. EL 1, & CH 1, October 1962

ELECTRICAL ENGINEERING DIVISION

Costing for Tariff Purposes in Electricity Supply

B. K. Banerjee
Associate Member

The electricity supply industry in India is managed by the public and private sectors. The standard accounting methods as practised by private electricity supply companies as required under the Indian Electricity Rules, 1956, are not followed by the public sector undertakings. In this paper, the author stresses the importance of following a uniform method, so that cost analysis and research can be employed usefully.

Obligation of a Power Supply Undertaking to Users of Power and Legislative Measures to Protect the Right of Consumers

N. K. De Sirkar

Non-member

Because the security and adequacy of power supply is unavoidable for the economic and social growth of a community, the question is of vital interest. Hence, in its own interest, the industry has a right to regulate the power supply business to assure (i) power availability in adequate quantity at all times, and (ii) power supply at economically beneficial rates. This paper briefly discusses the circumstances which led to the take-over of power supply by the State from private organizations, and stresses the importance of providing access to the consuming public to scrutinize the State organization to enable them to protect their rights.

Code of Practice for Operation and Maintenance of Power Systems

S. C. Ghose

Associate Member

This code of practice for operation and maintenance of power systems explains the author's experience in this particular field. Power engineers must maintain a high degree of efficiency, which in turn will reflect favourably upon the operation of the power system. It is up to the power engineers to visualize the various aspects of power to ensure continuity of power supply to the consumers.

In this paper, mention is made of the organization of personnel required to work on the power system, with particular emphasis on the aspects of division of responsibility and coordination. General instructions, clearance procedures and safety codes are of importance in maintenance and operational works. As the equipments require regular maintenance, it necessarily follows that such maintenance work should be properly recorded for analysis and future reference. For the development of any power system, statistical data are a prerequisite. Difficulties arising out of running in parallel with a grid system of small power stations is discussed and methods to obviate repercussions in the case of the failure of grid power, with particular reference to the Sijua (Jharia) power station, have been mentioned. A committee of experts should be to go into each case of fault or failure and advise remedial measures. The problems of load shedding and inspection are alao mentioned.

Load Forecasting

T. N. Idnani

Non-member

Electric power is the key factor in maintaining and advancing economic growth of a country. Of the two methods, *viz.*, (a) statistical and (b) field survey, the latter method is generally adopted for forecasting power requirements for (i) domestic purposes, (ii) commercial lighting and small power, (iii) street lighting, (v) industrial power, (v) irrigation, (vi) traction, and (vii) water supply and drainage. Power development under the First and Second Plan and its utilization as well as the pattern of future requirements and development is briefly discussed in this paper.

Power Development in the Eastern Zone

S. S. Kumar
Member
and
Ram Mohan
Non-member

In view of the vital importance of electrical energy in the economic development of a country, it is unavoidable that power availability is carefully worked out so that the other related developments of the economy in the Plans are not held up due to shortage of electric power. A brief study of the load growth under different heads, *viz*., (i) domestic and commercial lighting and small power loads, (ii) public lighting, (iii) industrial loads, (iv) irrigation loads, (v) railway electrification, and (vi) water supply and drainage, is made in the eastern zone comprising the reorganized States of Assam, Bihar, Orissa and West Bengal and the Centrally Administered Territories of Manipur, Tripura and Andaman and Nicobar Islands. A brief survey of the generating capacity of the power projects and their outlays, and the present consumption and future requirements of power in each entity of the eastern zone has led to the conclusion that the installed generating capacity has not been keeping pace with the increase in power demand. Planning for power sufficiently in advance has become a must, since a thermal project requires 4 to 5 years to be commissioned and a hydro project takes from 7 to 8 years for the power benefits to be available.

Some Thoughts on Commercial Matters in the Power Supply Industry in India

P. R. Roy Choudhury
Associate Member

Since independence, the power supply industry in India is receiving the attention of the Government which has taken upon itself the responsibility of providing cheap and adequate power to the nation as opposed to its meagre activity in the pre-independent era in this field. In this paper, the author has discussed the problem of power development in its relation to (i) finance, (ii) accounts and audit, and (iii) tariffs. The problem of financing power projects and the part to be played by the State Electricity Boards is dealt with. The present system of costing in the public and private sectors is outlined, and the desirability of following a uniform method has been emphasized. Even though, the cost of electricity in industry was only about 1 to 2% of the production excepting in the electrochemical and electrometallurgical industries, an increase in the cost which will not affect production and inhibit its development could be considered.

CHEMICAL ENGINEERING DIVISION

Study of Primary Air Entrainment in Gas Jet Burners

G. S. Davies
Non-member

and

S. G. Mukherjee
Non-member

The demand for increased productivity in industry is a challenge to combustion engineers to develop gas fired industrial heating methods by which the heating rates can keep pace with the general speeding up of manufacturing processes as a whole, particularly from the consideration that large quantities of surplus gas from coke ovens and petroleum refineries will be available in our country. This challenge can be successfully met provided faster and more efficient methods are developed, as, otherwise, these surplus byproduct gases will go waste.

For this purpose, jet burners are ideally suitable. Jet burners can be used for two purposes : (i) if the available combustible gas has sufficient pressure, it can be used as a driving fluid to draw the air required for combustion; (ii) alternatively, high pressure air can be used as a driving fluid to draw the combustible gas. In this paper, as a first phase, the former method has been studied although it seems that the latter has enough prospects. Jet burners are essentially jet pumps to drive combustion products through industrial appliances using jet driven recirculation. In a recent paper, Henwood has listed a variety of applications in chemical engineering process work. It seems that the possible field of application of jet burners is wide and their use will increase considerably.

Utilization of Low Grade Fuels

A. K. Shaha
Member

The paper briefly refers to such aspects as calorific value and calorimetric temperature and availability of low grade fuels in India, rational and scientific uses of these fuels, the technology of combustion processes, processing of fuels prior to utilization, enrichment of low grade fuels, and practical examples in their use and the expected economy.

INSTITUTION NOTICES

An appeal for contribution of papers in the Mechanical Engineering Division

With a view to provide greater service to members and specialists in the different branches of engineering in their fields of work and facilitate better flow of knowledge, the *Journal* of the Institution is at present issued in seven Division Parts, one of them devoted to the Mechanical branch which has in recent years made tremendous strides, the results of all of which have ultimately to be turned towards human utility. We have set on our national Plans, and consequently the engineering profession in our country is charged with a great responsibility. To handle the enormous amount of work that is entrusted to us and turn them to advantage, we must concentrate our attention towards increased learning and dissemination of technical knowledge.

In this context, may I appeal to members to contribute more and more papers on subjects relating to mechanical engineering for publication in our Institution *Journal* as this is one of the major ways of promoting the cause for which the Institution stands.

(T. R. Gupta)
Chairman, Mechanical Engineering Division

Forty-third Annual Convention, Bangalore, February 2-9, 1963

The 43rd Annual Convention of the Institution will be held in Bangalore between February 2-9, 1963. The details of the programme are given earlier in this *Bulletin*.

During the Convention, as decided by the Council, Symposia will be held as detailed below in the various Divisions on the subjects mentioned against each.

1. Civil Engineering Division .. 'Engineering Construction and Materials'
2. Mechanical Engineering Division.. 'Automation in Industry'
3. Electrical Engineering Division .. 'Analogies in Engineering'
4. General Engineering Division .. 'Some Aspects of Engineering Education'

Students' Session at the 43rd Annual Convention, Bangalore, February 1963

It is proposed to hold a Student Chapter at the 43rd Annual Convention in Bangalore in early February 1963. Only Student members of this Institution can take part in this Chapter. Technical papers for presentation at this Chapter should be sent to the Honorary Secretary, Student Chapter, The Institution of Engineers (India), Mysore Centre, Mysore Engineers Association Building, Bangalore 1, so as to reach him on or before December 20, 1962. It is decided to award a prize to the best paper presented.

Symposium in the General Engineering Division at the 43rd Annual Convention, Bangalore, February 2-9, 1963

The Chairman of the General Engineering Division, Shri R. N. Joshi, M.I.E., has proposed the subject 'Some Aspects of Engineering Education : (i) Do We Need More Engineering Colleges? (ii) Fits and Misfits amongst Engineering Students; and (iii) Desirability of Assessment of Term Work in Engineering Examinations', for the symposium to be held in the General Engineering Division at 43rd Annual Convention of the Institution at Bangalore in early February 1963.

Recognition of Qualifications for Exemption from Studentship and Associate Membership Examinations

The Council in their 426th Meeting held at Calcutta on August 12, 1962, have decided to recognize the following qualifications for exemption from Studentship and Associate Membership examinations.

For exemption from Studentship Examination

Director of Education, Madhya Pradesh, Gwalior	.. Defunct Diploma course in (i) Civil and (ii) Mechanical and Electrical Engineering

For exemption from Section A Examination

Jamshedpur Technical Institute	.. Diploma in Mechanical Engineering*

For exemption from Sections A and B Examinations

Rajasthan University	.. M.Sc. (Tech.) in Electronics†

Applications forms for Studentship

It is noticed that a large number of application forms for Studentship are received in this office which are not legibly and clearly filled in. In a large number of cases, the information asked for is not given properly. This causes considerable difficulty in the scrutiny of the applications and hence delay in their disposal. Corporate Members signing as Supporters in Studentship applications are therefore requested to ensure that the applications are legible, clear and complete in all respects.

Draft Indian Standard

The following draft Indian Standard has been issued recently.

Draft Indian Standard Colour Code for the Identification of Pipelines—Doc: SMDC 1(347).

This Standard prescribes a colour scheme for the identification of the contents of pipelines in buildings and industrial installations.

Members may send their comments on the above Standard before December 24, 1962, to Dr. D. R. Malhotra (M.), Golf Course Road, Ajmer, who is the Institution representative on the Sectional Committee dealing with this Standard.

Copies of the draft Standard may be obtained from the office of the Indian Standards Institution, 9 Mathura Road, New Delhi; or from its branch offices at 232 Dr. Dadabhoy Naoroji Road, Bombay 1; 11 Sooterkin Street, 3rd Floor, Calcutta 13; 2/21 First Line Beach, Madras 1; or 14/69 Civil Lines, Kanpur.

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* Students who obtained the Diploma prior to 1962 will be exempted from Section A provided they appear in and pass an examination in the deficient subject, and are certified to this effect by the Superintendent of Training, Jamshedpur Technical Institute.

† Candidates qualifying for the M.Sc. (Tech.) degree in Electronics must have passed in the paper on 'Drawing and Design of Electrical and Electronics equipment, apparatus, etc.'

Technical Dictionary on Prestressed Concrete

In many foreign periodicals, articles on prestressed concrete are published regularly, the reading of which is often difficult due to the use of words and expressions which cannot be found in the technical dictionaries which are at present available. In order to solve this difficulty, Federation Internationale de la Precontrainte have issued a dictionary of prestressed concrete, the execution of which was entrusted to the Netherlands Study Association of Prestressed Concrete (STUVO) at Amsterdam. The dictionary contains about 2,000 words and expressions in seven languages, *i.e.*, Dutch, English, German, French, Italian, Netherlands, Russian and Spanish, for which purpose cooperation from experts in prestressed concrete in the countries where these languages are used was obtained. The price of the dictionary is hf. 1.30. It can be obtained from The Netherlands Study Association of Prestressed Concrete, Herengracht 507, Amsterdam, by remitting this amount or its equivalent in Indian currency, payable to the account of the STUVO at the Amsterdamsche Bank at Amsterdam.

Revised list of Referees for Students appearing in Section B of Associate Membership Examination

The following is a revised list of referees for Students appearing in Section B of the Associate Membership Examination of the Institution.

Andhra Pradesh Centre

1. AM 7097 Akthar Husain (M, E)
c/o Dr. Khursheed Husain, 11-5-335 Red Hills, Hyderabad 4.

2. AM 7668 K. V. Apparao (M)
Lecturer in Mechanical Engineering, College of Engineering, Andhra University, Waltair.

3. AM 1295 P. V. Apparao (C, M)
Chartered Engineer, 8/1A Official Colony, Maharanipet, Visakhapatnam-2.

4. AM 1136 S. K. Badrinath (C)
10-2-289/8 Shantinagar, Hyderabad 4.

5. AM 4094 S. Balasubrahmanyam (C)
Tests & Control Engineer, Nagarjunasagar Project, P.O. Vijayapuri North, District Nalgonda.

6. AM 5565 Prof. S. L. Balasubrahmanyam (M)
Professor of Mechanical Engineering, College of Engineering, Kakinada.

7 AM 4302 G. Bapurao (C)
Executive Engineer Heay Electricals Ltd., B-1-174 Fateh Maidan Road, Hyderabad 4.

8. AM 9056 I. Basavaraju (E)
Divisional Engineer (Electrical), Office of S. E. (Technical), Electric Department, 10-2-3 A.C. Guards, Hyderabad.

9. AM 5161 P. Bhairavamurthy (C)
Assistant Professor of Civil Engineering, Engineering College, Kakinada.

10. AM 4419 R. Chandrasekara Rao (C)
Executive Engineer, Dam Division No. 3, Nagarjunasagar Dam, P.O. Vijayapuri North, District Nalgonda.

11. AM 4930 N. V. Chalapati Rao (C)
Superintending Engineer, Nagarjunasagar Right Canal, Hill Colony, P.O. Vijayapuri North, District Nalgonda.

12. AM 5654 G. V. Chelapathi Rao (MM)
Chartered Engineer, 22/176 Dornakal Road, Suryaraopet, Vijayawada 2.

13. M 1442 V. A. Choudary (M, E)
Chartered Engineer. Sundara Mahal, Durga Agraharam, Vijayawada 2.

14 AM 3183 P. N. Damodaram (C)
Professor of Civil Engineering, Engineering College, Kakinada.

15. M 2439 B. B. Das Gupta (M)
Mechanical Engineer, Hindusthan Shipyard (P) Ltd., Gandhigram, Visakhapatnam 5.

16. AM 8621 M. J. David (C)
Principal, Vuyyuru Polytechnic, Vuyyuru, District Krishna.

17. M 1889 R. Dwaraka Pershad (C)
Secretary, Singareni Collieries Co., Ltd., 3-6-601 Himayatnagar, Hyderabad.

18. AM 6502 P. Ethirajulu (C)
Divisional Engineer, Highways, Nandyal, District Kurnool.

19. AM 4042 G. B. Gadre (M, E)
Chief Engineer, Body Building, Hyderabad Allwyn Metal Works Ltd., P.O. Sanatnagar, Hyderabad.

20. AM 6174 B. Gopalakrishna Murthy (C)
Executive Engineer, No. 2 Special Investigation Division, Nagarjunasagar Project, Nakarikallu, District Guntur.

21. AM 2775 S. Gopalan (C)
Executive Engineer, P.W.D. (I.B.), Nizamabad.

22. AM 2944 M. Gopal Rao (C)
Executive Engineer, Dam Construction Division No. 1, P.O. Vijayapuri North, District Nalgonda.

23. M 2089 Guru Pershad (M)
Chief Executive Officer, A.P.R.T.C., Kailash, Malakpet, Hyderabad.

24. AM 5860 G. K. S. Iyengar (C)
Executive Engineer, P.W.D., M.I.P. Survey Division, 3-4/529 Narayanguda, Hyderabad.

25. AM 9051 Capt. V. E. Joseph (M)
Officer Commanding E.M.E. Workshops, Visakhapatnam.

26. AM 3383 F. J. Jussawalla (M, E)
Chartered Engineer, Krishna Vilas, P.O. Begumpet, Hyderabad.

27. M 1081 M. A. Kadeer (C)
Retired Director, Hyderabad Engineering Research Laboratories, Rahat Manzil, Saifabad, Hyderabad.

28. AM 2926 K. K. Kamalakar (M, E)
Official Colony, Maharanipet, Visakhapatnam 2.

29. AM 8572 A. S. Kameswar Rao (M)
Executive Engineer, Tunnels Division, Nagarjunasagar Right Canals, P.O Vijayapuri South.

30. AM 3257 J. Karra (C)
Chartered Engineer, 15 C Class Quarters, Tandoor Collieries, Bellampalli.

31. AM 1448 S. S. Kosnam (C)
Executive Engineer, Kamal Nivas, 672 Himayatnagar, Hyderabad 29.

32. AM 6369 B. Kotaiah (M)
Executive Engineer, Workshop & Machinery Division, Nagarjunasagar Project, Macherla, District Guntur.

33. AM 4223 K. Krishnamacharyulu (C)
Department of Civil Engineering, Andhra University, Waltair.

34. AM 1928 C. Krishnamurthy (E)
Executive Engineer (Electrical) Operation, A.P. Electricity Board, Mint Compound, Hyderabad 4.

35. AM 5840 D. Krishnamurthy Rao (C)
Executive Engineer, P.W.D., special Investigation Division, Waltair.

36. AM 2973 B Krishnarao (M, E)
Deputy Estate Engineer, Industrial Estate, Vijayawada.

37. M 2042 D. V. Krishnarao (E)
Departmental Manager, Electrical Department, Voltas Ltd., 87D Rashtrapathi Road, Secunderabad.

38. AM 5080 P. Krishnareddy (C)
Railway Superintendent, The Nizam Sugar Factory Ltd., Shakkarnagar, District Nizamabad.

39. AM 1065 B. R. Krishniengar (C)
Retired Executive Engineer, P.W.D., Gokul, Hardikarbagh, Himayatnagar, Hyderabad.

40. AM 6556 A. Kurmarao (M)
Proprietor, The Pioneer Engineering Works, D-2 Industrial Estate, Visakhapatnam.

41. AM 3954 G. Kutumbarao (M, E)
Inspector of Boilers, Behind Employment Exchange, Khairatabad, Hyderabad 4.

42. AM 6661 M. Lakshmanaswamy (C)
Executive Engineer, Godavari Head Works Division, Dhowleswaram, Rajahmundry, District East Godavari.

43. AM 6677 N. Lakshminarayana (M, E)
Electrical Engineer, Andhra Scientific Company, Masulipatam, District Krishna.

44. AM 4178 S. Laxmiah Chetty (C)
Assistant Engineer, P. O. Subedari, Warangal.

45. AM 4774 Y. Madhavendrarao Naidu (C)
Executive Engineer, P.W.D., Special Investigation Division, Vijayanagaram, District Visakhapatnam.

46. AM 1526 N. R. Magal (C)
Engineer & Contractor, Phulbagh, Himayatnagar, Hyderabad.

47. M 1735 V. G. Mohanraj (E)
Principal, S.M.V.M. Polytechnic, Tanuku, District West Godavari.

48. AM 5303 T K. Mohanrao (C)
Executive Engineer (Technical), Chief Engineers Office, Nagarjunasagar Dam, P.O. Vijayapuri North, District Nalgonda.

49. AM 2057 Zafer Mohiuddin (C)
Executive Engineer, P.W.D., Rangapur Bridge Division, Mahbubnagar.

50. M 1613 C. V. D. Moorthy (E)
Director, Technical Education Department, A9/872 Hyderaguda, Hyderabad.

51. AM 1860 C. N. Muire (M, E)
Executive Engineer, Transmission Line Division, Electrical Department, Mint Compound, Hyderabad.

52. AM 5830 J. A. Murray (C)
Executive Engineer, Andhra Pradesh State Electricity Board, 1-40-45 Raja Veedhi, Rayamundry, District East Godavari.

53. AM 4835 K. R. K. Murthy (E)
Divisional Engineer, A. P. State Electricity Board, Gudur, District Nellore.

54. AM 6243 Y. S. K. Murthy (E)
Divisional Electrical Engineer (Operation), Vijayawada Municipality, 25094 Prakasam Road, Vijayawada 2.

55. AM 4957 Prof. M. Muthukrishnudu (E)
Professor of Electrical Engineering, College of Engineering, Kakinada.

56. M 1654 I. Nagabhushanarao (C)
Civil Engineer, M/s Gannon Dunkerley Ltd., Maharanipet, Visakhapatnam 2.

57. AM 4140 K. Nagabhushanarao (C)
Retired. Executive Engineer Ramaraopet, Kakinada.

58. AM 6142 G. V Narapareddy (C)
Engineer & Contractor, B/O Pattabhipuram, Guntur 4.

59. AM 3844 P. Narasiah (M)
Director, Small Scale Industries, 91 Maredpalli, Secunderabad.

60. AM 5640 A. V. Narasimham (C)
Executive Engineer, P.W.D., Srikakulam.

61. AM 1988 R. K. V. Narasimham (C)
Director, A. P. Engineering Research Laboratories, 180 Road No. 6, Maredpalli, Secunderabad.

62. M 1758 G. A. Narasimha Rao (C)
Chief Engineer, Nagarjunasagar Canals, Erram Manzil. Hyderabad 4.

63. AM 4634 A. Narasinga Rao (C)
Retired. Deputy Chief Engineer, P.W.D., Sundara Mahal, Durgivari Street, Gandhinagram, Vijayawada 3.

64. AM 5393 S. R. Nayak (M, E)
Chief Engineer, Tungabhadra Industries, Kurnool.

65. M 1106 V. G. Panvalkar (C)
Chartered Engineer, Radha Kunj, 72 Maredpalli, Secunderabad.

66. M 1792 R. M. Patri (M, E)
Works Manager, Hyderabad Allwyn Metal Works Ltd., P.O. Sanatnagar, Hyderabad 16.

67. AM 4761 R. Prabhala (C)
Divisional Engineer, (Highways), Cuddapah.

68. AM 6968 P. V. S. Prasadarao (C)
Executive Engineer, P.W.D., Pochampad Survey Division, 16-9-907 Chenchelguda, Hyderabad.

69. AM 6916 P. B. Punniah (C)
Divisional Engineer, (Highways), Nellore.

70. AM 6851 Dr. J. Purushottam (C)
Deputy Director (Designs), P.W.D., Erram Manzil, Hyderabad.

71. AM 1691 M. Raghaviah (C)
Divisional Engineer, (Highways), Kakinada.

72. AM 8844 T. S. Raghavan (C)
Head of Civil Engineering Department, Government Polytechnic, Proddatur, District Cuddapah.

73. AM 6706 A. G. Raghottamarao (C)
Executive Engineer T.B.P. Division, District Kurnool.

74. AM 6659 A. Rahman (C)
Divisional Engineer, (Highways), Srikakulam.

75. M 2318 M. A. Rahman (C)
Chief Engineer, P.W.D., Minor Irrigation Projects, Erram Manzil, Hyderabad.

76. AM 3796 Rajeswarrao Kache (C)
Divisional Engineer, P.W.D., (R & B.) Khammam.

77. AM 5878 R. L. Raju (C)
Deputy Chief Engineer, Chief Engineer's Office, Nagarjunasagar Canals, P.O. Vijayapuri North, District Nalgonda.

78. M 946 Dr. S. P. Raju (C)
Red Hills, Hyderabad.

79. AM 6178 K. Ramabrahman (C)
Superintending Engineer, Upper Sileru Hydro-Electric Scheme, Chintapalli, *via* Narsapatnam, District Visakhapatnam.

80. AM 2409 T. V. Ramachandra Rao (C)
Chartered Engineer, Rowjee Press, Adoni, District Kurnool.

81. AM 8870 T. V. Ramanarao (C)
Head of Civil Engineering Department, Government Polytechnic, Mahbubnagar.

82. AM 7642 G. Ramanareddy (M)
Gandavaram, Taluk Kovur, District Nellore.

83. AM 5836 K. S. Ramanathan (M)
Chief Engineer, Andhra Sugar Ltd., Tanuku, District West Godavari.

84. AM 2389 S. T. L. K. V. N. S. Ramanujachari (M)
3-3-900/1 Kutbiguda, Hyderabad.

85. AM 6834 C. V. Ramarao (C, M)
Assistant Engineer, (Highway) Office, Begumpet, 12/4 R.T.L.I.G.R., Barkatpura Hyderabad.

86. AM 1803 J. V. Ramarao (E)
Divisional Engineer (Electrical) Operation, Circle, Telangana, Secunderabad.

87. AM 1883 P. S. Ramarao (M, E)
Head of Mechanical Engineering Section, Government Polytechnic, Visakhapatnam.

88. AM 3464 T. V. S. Rama Rao (E)
Electrical Engineer, Nellimarla, District Visakhapatnam.

89. AM 6484 V. Ranganatha Rao (C)
Deputy Director (Design), Erram Manzil, Hyderabad.

90. AM 4166 A P Ranganathaswamy (C)
Superintending Engineer, Nagarjunasagar Dam, P.O. Vijayapuri North, District Nalgonda.

91. AM 6351 K. C. Rao (M)
Deputy Director, Department of Commerce & Industries, Chiragh Ali Lane, Hyderabad 1.

92. M 1655 Prof. V. V. L. Rao (E)
Principal, College of Engineering, Anantapur.

93. AM 3609 B. T. Revathi (E)
Executive Engineer, Construction and Operation, Andhra Pradesh State Electricity Board, P.O. Hanmakonda, Warangal.

94. AM 8590 K. C. Reddy (M)
Officer-in-Charge, Technical Section, Chief Engineer's Office, Nagarjunasagar Canals, P.O. Vijayapuri North, District Nalgonda.

95. AM 8684 K. S. Reddy (M)
Inspector of Factories, Mahbubnagar.

96. AM 4040 A. S. Sarma (E)
Chartered Engineer, 1-8-338 Chikkadpalli, Hyderabad.

97. AM 4779 B. A. Sarma (C)
Executive Engineer, P.W.D., Eleru Division, P.O. Peddapuram, District East Godavari.

98. AM 5234 P. H. N. B. Sarma (E)
Principal, Andhra Polytechnic, Kakinada.

99. AM 4077 J. B. Sastry (C)
Chartered Engineer, P.O. Gandhigram, Visakhapatnam.

100. AM 5309 K. L. Sastry (C)
Executive Engineer, M.P.R. Division No. 1, P.O. M.P.R. Site, District Anantapur.

101. AM 8591 A. Satyanarayana (C)
Executive Engineer, P.W.D., Construction Division No. 1, Pochamped Project, P.O. Doodgaon, District Nizamabad.

102. AM 6176 M. Satyanarayan (E)
Resident Engineer, Crompton Engineering Co. (Madras), Ltd., Post Box No. 97, Vijayawada.

103. AM 8101 H. S. Seshagirirao (MM)
Chartered Engineer, 3-6-614 Himayatnagar, Hyderabad.

104. M 2183 E. Seshagirirao Naidu (C)
Engineer, Singareni Collieries Co., Ltd., P.O. Kothagudium Building, *via* Bhadrachalam Road.

105. M 1530 C. Seshavataram (C)
Retired. Chief Engineer, P.W.D., Gaganmahal Cooperative Colony, Hyderabad.

106. AM 3893 E. Shanker Rao (E)
Executive Engineer (General), Ramagundam, District Adilabad.

107. AM 10034 V. Singappa (C)
Assistant Professor of Civil Engineering, Engineering College, Anantpur.

108. AM 4072 T. K. Sitaramaiah (M)
Chief Inspector of Boilers, Government of Andhra Pradesh, Behind Employment Exchange, Khairatabad, Hyderabad.

109. AM 6227 R. Sitaramaraju (M, E)
Executive Engineer (Electrical), Government Electric Department, 19/226 V.T.H. School Street, Innespet, Rajahmundry.

110. AM 5574 M. Sivaramaiah (C)
Executive Engineer, P.W.D., K. C. Canal Localization Division, Nandyal, District Kurnool.

111. AM 3234 M. R. Sripadarao (C)
Chartered Engineer, Soudamani, Waltair.

112. AM 9574 V. R. Sriram (C)
Assistant Civil Engineering, Hindustan Shipyard (P) Ltd., Gandhigram, Visakhapatnam 5.

113. AM 2157 V. Subbaraju (M, E)
Superintending Engineer, Directorate of Agriculture, Shapurwadi, Hyderabad.

114. AM 5823 K. Subbarao (C)
Superintending Engineer, Special Public Health Engineering Circle, Visakhapatnam.

115. AM 7355 K. V. Subbarao (M)
Executive Engineer, P.W.D., Krishna Central Division, Vijayawada 2.

116. AM 5350 N. Subbarao (C)
Chartered Engineer, Anandtirth Agraharam, Guntur.

117. AM 6657 P. L. Subrahmanyam (C)
Executive Engineer, P.W.D., Karimnagar.

118. AM 1713 A. Suryanarayana (C)
Garrison Engineer, M.E.S., Mudfort, Secunderabad.

119. AM 7512 J. D. Talati (M, E)
Electrical & Mechanical Engineer, Singareni Collieries Co., Ltd., Tandoor Collieries, P.O. Bellampalli.

120. AM 6292 S. M. Takur (M)
Workshop Superintendent, Regional Engineering College, Warangal.

121. AM 1724 Md. Usman (C)
Chief Engineer (Highways), P.W.D., Begumpet, Hyderabad.

122. AM 7828 S. K. Varma (E)
Power House Engineer, Sirpur Paper Mills Ltd., Sirpur, Kagaznagar.

123. AM 5694 B. K. Veerabhadra Rao (C)
Executive Engineer, P.W.D., Bharati Hospital, 18/2 Arundulpet, Guntur 2.

124. AM 9323 T. Venkatacharyulu (C)
Assistant Professor of Civil Engineering, Regional Engineering College, Warangal.

125. M 1891 G. Venkataraman (M, E)
Senior Electrical Engineer, Singareni Collieries Co., Ltd., P.O. Kothagudium *via* Bhadrachalam Road.

126. AM 9694 B. Venkatarama Reddy (C)
Executive Engineer, P.W.D., Flood Control Division, Eluru, District West Godavari.

127. AM 6393 V. S. Venkateswarrao (C)
Instructor, College of Engineering, Kakinada.

128. AM 9225 N. S. Venkateswar Rao (M, E)
Head of Electrical Engineering Section, S.M.V.M. Polytechnic, Tanuku, District West Godavari.

129. AM 3564 I. Venkataiah (E)
Assistant Engineer, Chief Engineers (Electricity) Office, Khairatabad, Hyderabad 4.

130. AM 9645 T. Venugopalrao (M)
Reader in Mechanical Engineering, Engineering College, Andhra University, Waltair.

131. AM 7128 G. M. A. Vijayaraghavan (C)
Assistant Engineer, P.W.D. (Highways), Madanapalli Sub-Division, P.O. Madanapalli. District Chittoor.

132. M 1374 E. Viraraghavan (C)
Retired. Superintending Engineer, 3-6-440 Hardikarbagh, Himayatnagar, Hyderabad.

133. AM 5589 Vithal Rao (C)
Executive Engineer, P.W.D., Construction Division No. 1, Manjira Barrage Scheme, P.O. Sangareddi, District Medak.

134. AM 9860 S. Somayajulu Yuchury (M)
Mechanical Engineer Operating, A.P.R.T. Corporation, Vijayawada.

Assam Centre

1. M 1186 H. P. Barua (C)
Kalpalata, Laban, Shillong.

2. M 2305 S. P. Chaudhury (C)
La Chaumiere, Shillong.

3. M 2067 K. C. Das (M, E)
Assam Oil Co., Ltd., Digboi.

4. M 1896 Prof. N. Das Gupta (C)
Principal, Assam Civil Engineering College, Gauhati.

5. M 1424 Prof. P. C. Dutt (E)
Principal, Jorhat Engineering College, Jorhat.

6. M 1363 G. Dutta (C)
Retired Chief Engineer & Secretary, P.W.D., Dilara, Laitumkhurah, Shillong.

7. M 1668 H. B. Gupta (M)
Chief Electrical Engineer Assam State Electricity Board, Shillong.

8. M 2017 G. C. Goswami (M, E)
Upland Road, Laitumokhrah, Shillong.

9. M 2339 K. L. Mazumdar (C)
Additional Chief Engineer, P.W.D. (R & B), Shillong.

10. M 1915 S. C. Pal (C)
Superintending Engineer, N. A. Circle, Tezpur, Darrang.

11. M 1744 M. Ramabrahmam (C)
Chief Engineer, Indian Refineries Ltd., Gauhati.

12. M 2424 P. Sharma (C)
Public Health Engineer, Shillong.

13. M 2121 R. J. Thaker (M)
Assam Engineering College, Jhalikbari, Gauhati.

Bengal Centre

1. AM 3475 A. M. Banerjee (M)
22 R.G. Kar Road, Calcutta 4.

2. AM 4777 B. K. Banerjee (E)
Divisional Engineer, West Bengal State Electricity Board, 173 Raja Dinendra Street, Calcutta 4.

3. AM 4686 Prof. D. Banerjee (M)
Head of Mechanical Engineering Department, Bengal Engineering College, P.O. Botanic Garden, Howrah.

4. M 2420 I. S. Banerjee (C)
c/o Bridge & Roof Co. (India), Ltd., 427/1 G. T. Road, Salkia, Howrah.

5. M 1698 K. C. Banerjee (C)
Consulting Engineering, Surveyor & Valuer, 12 Old Post Office Street, Calcutta 1.

6. AM 3805 N. K. Banerjee (M)
Inspector of Boilers, Government of West Bengal, 1 Hastings Street, 8th Floor, Calcutta 1.

7. M 1767 Prof. R. N. Banerjee (E)
Principal, Institute of Jute Technology, 35 Ballygunge Circular Road, Calcutta 19.

8. AM 5904 S. C. Banerjee (M)
Inspector, Smoke Nuisances' Commission, Government of West Bengal, 3B/3 Santosh Roy Road, Calcutta 8.

9. AM 4266 S. R. Banerjee (C)
Consulting Engineer, 2/G Brindaban Pal Lane, Calcutta 3.

10. AM 3170 S. N. Basak (C)
28/2 Brindaban Basak Street, Calcutta 5.

11. AM 3322 A. Basu (C)
District Engineer, South-Eastern Railway, Adra.

12. AM 2853 A. K. Basu (C)
P 820, Block P, New Alipore, Calcutta 33.

13. M 2192 S. Basu C, M)
143 Dharmatalla Street, Calcutta 13.

14. M 1254 Capt. B. N. Bhaduri (C)
P 82 Lake Road, Calcutta 29.

15. AM 2681 M. M. Bhattacharyya (C)
27 Santi Ghosh Street, Shambazar, Calcutta 4.

16. M 1285 Dr. S. C. Bhattacharyya (M)
49A Purna Das Road, Calcutta 29.

17. M 1831 S. C. Biswas (C)
10 Dr. Suresh Sarkar Road, Calcutta 14.

18. AM 8761 A. Bose (M)
Netra, District 24 Parganas.

19. AM 4526 D. K. Bose (C)
Deputy Director, Small Industries Service Institute, 12 Kalidas Sinha Lane, Calcutta 9.

20. M 2381 K. Bose (Ch)
11 Bondel Court, 84B Bondel Road, Calcutta 19.

21. AM 6601 P. K. Bose (C).
8A Jogesh Mitter Road, Calcutta 25.

22. AM 1622 B. Bysakh (M)
55 W. C. Banerjee Street, Calcutta 6.

23. AM 4265 N. N. Chakrabarty (E)
Electrical Inspector, Government of West Bengal, 1 Harish Mukherjee Road, Calcutta 20.

24. M 2147 D. K. Chakravarti (C)
Director. S. K. Chakravarti (P) Ltd., 10 Convent Road, Calcutta 14.

25. M 1511 R. Chakravarty (C)
Chief Engineer, Floods & Flood Control, Government of West Bengal, Writers' Building, Calcutta 1.

26. AM 4564 K. M. Chakravorti (E)
P 47 Saktigarh, Calcutta 32.

27. AM 4785 N. K. Chakravorty (E)
Electrical Engineer, Chief Electrical Engineers Office, Durgapur Steel Project, Durgapur 3.

28. AM 5151 Dr. B. Chanda (M)
Professor of Mechanical Engineering, Jadavpur University, Calcutta 32.

29. AM 7290 Dr. B. C. Chanda (Ch)
Chemical Engineering Department, Jadavpur University, Calcutta 32.

30. AM 3919 B. Chatterjee (E)
9 Jadav Lane, Calcutta 25.

31. AM 4821 Dr. G. P. Chatterjee (MM)
Chief Metallurgist, Durgapur Steel Project, P.O. Durgapur Coke Oven, Durgapur.

32. M 1220 H. P. Chatterjee (E)
Chief Electrical Engineer, Durgapur Steel Project, Durgapur 3.

33. M 2537 P. K. Chatterjee (M)
20/1 Roy Street, Calcutta 20.

34. AM 4631 Dr. P. N. Chatterjee (C)
Bengal Engineering College P.O. Botanic Garden, Howrah.

35. M 2008 S. Chatterjee (C)
Chief Engineer, Howrah Improvement Trust, 28 Beharilal Chakravorty Lane, Howrah.

36. M 1418 B. N. Chaudhuri (C)
Partner, Ballardie, Thompson & Mathews, 69 Jatin Das Road, Calcutta 29

37. M 1588 Prof. A. K. Das (E)
18/1B Raja Monindra Road, Calcutta 37.

38. AM 1183 D. Das (M)
Mechanical Engineer, 110 Upper Circular Road, Calcutta 9.

39. AM 2817 P. K. Das (C)
c/o Jessop & Co. Ltd., 63 Netaji Subhas Road, Calcutta 1.

40. M 827 J. N. Das Gupta (C)
Consulting Engineer, 27 Lansdowne Terrace, Calcutta 26.

41. M 2309 A. K. Datta (M, E)
Director-in-Charge, Lake Depot, C.S.T.C., 25 Dr. Deodar Rahaman Road, Calcutta 33.

42. M 2273 S. Datta (C)
Chief Surveyor & Valuer, Calcutta Port Commissioners, 15 Strand Road, Calcutta 1.

43. M 1177 D. S. Desai (C)
Director, M. N. Dastur & Co. (P) Ltd., 65 Jatin Das Road, Calcutta 29.

44. AM 2654 B. Dutt (E)
Superintending Engineer, West Bengal State Electricity Board, 183 Panchanantala Road, Howrah.

45. AM 9062 D. N. Dutt
Principal, Jadavpur Polytechnic, Calcutta 32.

46. AM 4497 N. Dutt (C)
5 Romanath Mazumder Street, Calcutta 9.

47. AM 4112 D. P. Ganguly (E)
Plot No. 809, Block P, New Alipore, Calcutta 33.

48. M 845 J. Ganguly (C)
Consulting Engineer, Surveyor & Valuer, 6 Hastings Street, Calcutta 1.

49. AM 5562 N. C. Ganguly (M)
Plant Engineer, Durgapur Project, P.O. Durgapur Coke Oven, Durgapur.

50. AM 4627 H. N. Ghosal (M)
Works Manager, Indian Oxygen Ltd., 1/24 Rupchand Mukherjee Lane, Calcutta 25.

51. M 2199 S. K. Ghose (M)
Inspector of Boilers, Government of West Bengal, 32A Chandranath Chatterjee Street, Calcutta 25.

52. AM 5655 P. K. Ghosh (E)
Divisional Engineer, West Bengal State Electricity Board, 80A Beltala Road, Calcutta 26.

53. M 2229 P. K. Ghosh (C)
Consulting Engineer, Surveyor & Valuer, 13A Beltala Road, Calcutta 26.

54. M 2403 S. Ghosh (M)
Chief Inspector & Secretary, Smoke Nuisances' Commission, Government of West Bengal, 60B Chowringhee Road, Calcutta 20.

55. AM 1293 S. K. Ghosh (C)
Chief Engineer, Road (Devlopement) Directorate, 503B Block M, New Alipore, Calcutta 33.

56. AM 4316 B. M. Goswami (E)
169 Vivekananda Road, Calcutta 6.

57. M 2095 S. M. Goswami (C)
Superintending Engineer, Construction Board, Government of West Bengal, 77 Monoharpukur Road, 1st Floor, Calcutta 29.

58. M 1393 Prof. H. C. Guha (E)
Professor-in-Charge, Electrical Engineering Department, College of Engineering & Technology, Jadavpur, Calcutta 32.

59. M 973 S. K. Guha (C)
Retired Chief Engineer, Irrigation & Waterways Directorate, Government of West Bengal, 25A Monohar Pukur Road, Calcutta 29.

60. M 1975 S. N. Gupta (C)
Chief Engineer, Special Roads Directorate, Government of West Bengal, 784 Block P, New Alipore, Calcutta 33.

61. M 1459 T. R. Gupta (M, E)
General Manager (Works), Jay Engineering Works Ltd., 183A Prince Anwar Shah Road, Dhakuria, Calcutta 31.

62. M 1316 Lt.-Col. S. K. Kanjilal (C, E)
Chief Engineer, Durgapur Project, 4th Floor, 67 Bentinck Street, Calcutta 1.

63. M 1740 B. Maitra (C)
Director, River Research Institute, Government of West Bengal, P 65/1 Dr. Sarat Banerjee Road, 2nd Floor, Calcutta 29.

64. AM 2703 Prof. P. N. Mathur (M, E)
Marine Engineering College, Taratolla, Calcutta 27.

65. M 2254 Prof. R. Mishra (M)
Professor of Mechanical Engineering (Production Technology), Indian Institute of Technology, Kharagpur.

66. M 1602 A. N. Mitra (E)
Superintending Engineering, P.W.D., Electrical Circle, Government of West Bengal, Writers Building, Calcutta 1.

67. AM 1429 S. K. Mitra (E)
9 Portland Park, Alipore, Calcutta 27.

68. AM 6478 I. Mookerjee (M)
251/A/4 Netaji Subhas Chandra Bose Road, Calcutta 40.

69. M 1718 H. C. Mukerji (C)
Chief Valuer, Calcutta Improvement Trust, 10 Netaji Subhas Road, Calcutta 1.

70. AM 5696 B. Mukherjee (M)
Craft Training Centre, A.C.C.I., P.O. Rishra, District Hooghly.

71. AM 2408 K. S. Mukherjee (M)
5 Commercial Buildings, 2nd Floor, Calcutta 1.

72. M 2152 S. S. Mukherjee (C)
Chief Personnel Officer, South-Eastern Railway, 6 Lower Circular Road, Calcutta 17.

73. AM 7439 A. K. Munshi (M)
Works Manager, Steel & Allied Products Ltd., 2/1 Hussain Shah Road, Calcutta 23.

74. AM 5686 H. Nandy (MM)
Chief Metallurgist, Bhartia Electric Steel Co., Ltd., 29A Kabir Road, Ground Floor, Calcutta 26.

75. M 1738 J. N. Neogi (C)
Consulting Engineer, Surveyor & Valuer, 74/6A Baghbazar Street, Calcutta 3.

76. AM 5748 S. C. Neogi (C)
Lecturer, Civil Engineering Department, Jadavpur Polytechnic, 23/60 Gariahat Road, Calcutta 19.

77. AM 4190 P. K. Paul (MM)
Assistant Superintendent, Steel Melting Shop, Durgapur Steel Project, P.O. Durgapur Coke Oven, Durgapur.

78. M 1872 S. A. Prabhu (E)
Power Engineer, Indian Iron & Steel Co. Ltd., P.O. Burnpur, District Burdwan.

79. M 1793 K. C. Ray (C)
Superintending Engineer, P.W.D., Planning Circle, Government of West Bengal, Writers Building, Calcutta 1.

80. AM 5285 Prof. S. N. Ray (E)
Principal, Regional Engineering College, Durgapur 4.

81. M 1207 Dr. H. L. Roy (Ch)
Retired Professor of Chemical Engineering, 47 Jadavpur Central Road, Calcutta 32.

82. M 1756 M. D. Roy (C)
c/o The Braithwaite, Burn & Jessop Construction Co., Ltd., P-13 Mission Row Extension, P.O. Box No. 264, Calcutta 1.

83. AM 7793 M. N. Roy (M)
Deputy Director of Industries (Training), Government of West Bengal, 67 Bentinck Street, Calcutta 1.

84. AM 4164 P. R. Roy Choudhury (E)
Deputy Commercial Engineer, Damodar Valley Corporation, Anderson House, Alipore, Calcutta 27.

85. M 1361 K. P. Roy Chowdhury (C, M, E)
3/19 T. N. Chatterjee Street, Calcutta 50.

86. AM 3055 N. N. Rudra (E)
Lecturer, Electrical Engineering Department, J. C. Ghosh Polytechnic, P 545 Block N, New Alipore, Calcutta 33.

87. AM 4569 R. S. Saigal (Ch, MM)
c/o Indian Oxygen & Acetylene Co., Ltd., 48/1 Diamond Harbour Road, Calcutta 27.

88. M 2022 P. B. Sarkar (C)
9/2 Fern Road, Calcutta 19.

89. M 1633 A. K. Sen (C)
45 Ballygunge Place, Calcutta.

90. AM 2945 A. K. Sen (C)
Executive Engineer, Berhampur Irrigation Division, P.O. Berhampur, District Murshidabad.

91. AM 4668 A. S. Sen (M)
P 483 C.I.T. Scheme XLVII, Calcutta 29.

92. M 2123 D. M. Sen (C, M)
c/o Martin Burn Ltd., 12 Mission Row, Calcutta 1.

93. AM 5108 Prof. G. C. Sen (M
Head of Mechanical Engineering Department, Jadavpur University, Calcutta 32.

94. M 2188 B. N. Sen Gupta (E)
Chief Electrical Inspector, Government of West Bengal, 1 Harish Mukherjee Road, Calcutta 20.

95. AM 3539 K. C. Sen Gupta (C)
35/1-B Panditiya Road, Calcutta 29.

96. M 1789 N. N. Sen Gupta (E)
Principal, Calcutta Technical School, 110 S. N. Banerjee Road, Calcutta 13.

97. M 1811 P. N. Sen Gupta (C)
Divisional Manager, Shalimar Tar Products (1935) Ltd., 6 Lyons Range, Calcutta 1.

98. M 1592 H. N. Sil (C)
26A The Crescent, P.O. Burnpur, District Burdwan.

99. M 2064 A. E. Young (C)
Chief Engineer, Alloy Steel Project, 3/5 Vivekananda Road, Durgapur 4.

Bihar Centre

1. M 1898 R. P. Agarwala (C)
Retired Superintending Engineer, Sahu Road, Muzaffarpur.

2. M 2227 B. N. Aich (C)
Superintending Engineer, Central Design Office, Kosi Project, Patna.

3. AM 7421 J. Bahadur (C)
Sinha Library Road, Patna.

4. AM 5333 P. C. Banerji (M)
2 Victoria Road, P.O. Jamalpur, District Monghyr.

5. AM 4358 Bikram Jit C)
Resident Engineer, B.N.C.C. Ltd., Patevatu, District Hazaribagh.

6. M 2132 Dr. A. K. Chatterjee (E)
Vice-Principal and Head of Department of Research, Birla Institute of Technology, P.O. Mesra, Ranchi.

7. M 2110 B. Chaudhary (C)
Professor of Civil Engineering, Muzaffarpur.

8. M 2332 Dr. J. P. Choudhury (M)
Director, Bihar School of Technology, P.O. Sindri Institute, District Dhanbad.

9. AM 5048 A. Das Gupta (C)
Superintending Engineer, Quality Control Organization, Kosi Project, P.O. Birpur, Saharsa.

10. AM 5801 B. L. Fernandez (M, E)
Assistant Superintendent of Training, Tata Iron and Steel Co., Ltd., Jamshedpur.

11. M 2409 S. K. Ghose (C)
Engineering College, Bhagalpur 3.

12. AM 6587 R. K. Gupta (M)
Assistant Professor of Mechanical Engineering, Muzaffarpur Institute of Technology, Muzaffarpur.

13. AM 5451 C. S. Iyer (M, E)
Deputy Chief Engineer (Mechanical), Heavy Machine Building Plant, Heavy Engineering Corporation, P.O. Dhurwa, Ranchi.

14. M 1395 U. S. Jayaswal (C)
Regional Engineer, Sahu Cement Service, Patna 1.

15. AM 4690 V. S. Kulkarni (C)
072, Nildih Colony, P.O. Golmuri, Jamshedpur 3.

16. AM 8363 K. N. Lal (C)
Executive Engineer, Canal Division No. 6, Kosi Project, P.O. Madhepura, Saharsa.

17. M 1450 S. N. Mitra (C)
Dakshyani Kutir, I Circuit House Area, Jamshedpur.

18. AM 7069 R. K. Mukherji (E)
Lecturer in Electrical Engineering, Eastern Railway Technical School, Jamshedpur.

19. M 1761 B. Ohja (C)
Birla Institute of Technology, P.O. Mesra, Ranchi.

20. M 2413 M. S. Pai (E)
Professor, Indian School of Mines, Dhanbad.

21. M 1688 Maj. M. C. Pande (E)
Principal, Birla Institute of Technology, P.O Mesra, Ranchi.

22. M 2476 G. S. Prasad (C)
Superintending Engineer, P.W.D., Chotanagpur Circle, Ranchi.

23. M 1770 G. S. Purohit (E)
Retired Electrical Superintending Engineer, Kanmulal Road, Opposite Irrigation Department Quarter, Mithapore, Patna 1.

24. M 1971 K. N. Rohatgi (C)
Retired Chief Engineer, Yarpur, Patna.

25. AM 5462 Dr. B. N. Roy (M, E)
Deputy Director of Technical Education, Government of Bihar, Industries Department, Patna 1.

26. M 2434 J. D. Sahai (E)
Senior Electrical Inspector, Patna 1.

27. AM 8380 S. R. Sikdar (E)
c/o Indian School of Mines, Dhanbad.

28. AM 7804 D. P. Sinha (C)
Principal, Muzaffarpur Institute of Technology, Muzaffarpur.

29. M 2428 B. L. Singh (C)
Chief Engineer, Irrigation Department, Government of Bihar, Patna 1.

30. AM 2107 N. Sreenivasan (M)
Senior Lecturer in Mechanical Engineering, Indian School of Mines and Applied Geology, Dhanbad.

31. M 2286 B. P. Tripathi (C)
Superintending Engineering, Public Health Department, Ranchi Circle, Ranchi.

Bombay Centre

1 M 1007 K. R. Akerkar (C)
Trimbak Road, Nasik.

2. M 1272 K. F. Antia (C)
Rockside, 112 Walkeshwar Road, Malabar Hill, Bombay 6.

3. AM 2402 K. V. Apte (C)
3 Turner Road, Bandra, Bombay 50.

4. M 1753 M. N. Bapat (E)
c/o Tata Hydro-Electric Cos., Ltd., Bombay House, Bruce Street, Fort, Bombay 1.

5. AM 3184 V. P. Bapat (M)
Consulting Engineer, Gokhale Wadi, Bhawani Shankar Road, Dadar, Bombay 28

6. M 863 G. P. Bhandarkar (C)
Plot No. 56, Sion Road, Sion, Bombay 22.

7. AM 2342 M. S. Bhandarkar (C)
Architect & Engineer, Lentin Chambers, Dalal Street, Fort, Bombay 1.

8. M 1985 M. C. Bhansali (C)
Proprietor, Bhansali & Co., 94 Medows Street, Fort, Bombay.

9. M 1048 M. D. Bharucha (C)
c/o Hindusthan Construction Co., Ltd., Construction House, Nicol Road, Ballard Estate, Bombay 1.

10. AM 786 M. G. Bhatt (C)
c/o Kora & Bhatt, Architects, 22 Apollo Street, Fort, Bombay.

11. AM 1430 D. R. Bhise (C)
'Champak', 78 Shivaji Park, Dadar, Bombay 14.

12. M 1652 Dr. B. V. Bhoota (C)
Dorr-Oliver (India) Ltd., The International, 16 Queen's Road Estate, Bombay 1.

13. M 1384 J. G. Bodhe (C)
Consulting Civil Engineer, 24-28 Dalal Street, Fort, Bombay 1.

14. M 2827 Brig. S. K. Bose (C)
Director, Indian Institute of Technology, Powai, Bombay 76.

15. M 1069 N. C. Bulsara (C)
Block No. 8, Flat No. 11, Rustom Baug, Victoria Road, Bombay 27.

16. M 1834 C. K. Chokshi (C)
Jay Building, 2nd Road, Santa Cruz (East), Bombay 23.

17. M 1022 G. D. Daftary (C)
'Sneh Sadan', 114 Churchgate Reclamation, Bombay 1.

18. AM 1735 M. K. Dalal (E)
Meher Muncher Mansion, 512 College Road, Matunga, Bombay 19.

19. AM 5633 P. R. Dandavate (M, E)
Electrical Engineering Department, Victoria Jubilee Technical Institute, Matunga, Bombay 10.

20. M 2237 H. A. Dandekar (M, E)
168F Vincent Road, Dadar, Bombay 14.

21. M 2184 D. P. Dani (M, E)
522 Adenwala Road, Jogeshwari Nivas, Matunga, Bombay 19.

22. M 1574 J. D. Daroga (M)
7 Ness Baug, Nana Chowk, Bombay 7.

23. M 1664 C. V. Deshpande (C)
Managing Director, Sewri Engineering Construction Co., Ltd., Savoy Chamber, Wallace Street, Bombay 1.

24. M 1649 Prof. P. W. Dharap (M, E)
96 Hindu Colony, Dadar, Bombay 14.

25. M 907 K. T. Divecha (C)
Sykes, Patkar & Divecha, 24-26 Dalal Street, Fort, Bombay 1.

26. AM 4529 K. P. Dodeja (C)
c/o Karamchand Dodeja & Co., Architects and Engineers, Kitab Mahal, 1st Floor, Hornby Road, Fort, Bombay 1.

27. M 1856 J. H. Gandhi (C)
c/o Concrete Association of India, 121 Queen's Road, Fort, Bombay 1.

28. M 1498 N. S. Gupchup (C)
Construction House, Ballard Estate, Bombay 1.

29. M 1964 R. K. Gurtu (M, E)
2B Garden View, Flat No. 6, Prof. Almeida Road, Bandra, Bombay 20.

30. AM 2881 C. L. N. Iyengar (C)
c/o Concrete Association of India, 121 Queen's Road, Fort, Bombay 1.

31. M 1813 N. B. Iyer (M)
Association of India Automobile Manufacturers, Army Navy Building, Esplanade Road, Bombay 1.

32. AM 1802 N. V. Joshi (C)
21-22 Biradhar Manzil, Morbaug Road, Naigaum, Dadar, Bombay 14.

33. M 1902 V. Y. Kamat (M, E)
12 Dwarkadas Mansion, Sandhurst Road, Girgaon, Bombay 4.

34. M 859 B. P. Kapadia (C)
c/o Hindusthan Construction Co., Ltd., Construction House, Ballard Estate, Bombay 1.

35. M 955 K. V. Kini (C)
Consulting Civil Engineer, Lakshmi Building, Sir Phirozeshah Mehta Road, Fort, Bombay 1.

36. M 1175 S. M. Kini (C)
Civil Engineer, 134 Medows Street, Fort, Bombay 1.

37. AM 3332 G. D. Limaye (C)
c/o Concrete Association of India, 121 Queen's Road, Fort, Bombay 1.

38. AM 2386 D. N. Marathe (C)
c/o Marathe & Kulkarni, Architects, Surya Mahal, 5 Military Square Lane, Fort, Bombay 1.

39. M 2465 G. M. Marathe (E)
Superintending Engineer, Design & Coordination, Koyna Project, Mercantile Bank Building, Bombay 1.

40. M 918 W. X. Mascarenhas (C)
Southlands, Colaba, Bombay 5.

41. M 1853 B. A. Mehta (E)
43 Tamarind Lane, Fort, Bombay.

42. M 1969 P. V. Mehta (M, E)
Alpha Electric Engineering Co., 20 Calicut Street, Ballard Estate, Bombay 1.

43. M 1265 N. H. Mohile (C)
Concrete Association of India, 121 Queen's Road, Fort, Bombay 1.

44. M 976 S. G. Nadkarni (E)
Electrical Engineer, P.W.D. Secretariat, Bombay.

45. AM 1531 H. Narayana Rao (M, E, MM)
Seth Anandilal Podar's Bungalow, Ghod Bunder Road, Santa Cruz, Bombay 23.

46. M 1847 K. C. Pandya (C)
24B Hamam Street, Fort, Bombay 1.

47. AM 8412 H. C. Patel (M, E)
Assistant Professor of Mechanical Engineering, Victoria Jubiee Technical Institute. Matunga, Bombay 19.

48. M 2001 Y. G. Patel (C)
Patel Engineering Co., Ltd., United India Building, Sir Phurozeshah Mehta Road, Fort, Bombay 1.

49. M 2473 P. R. Parikh (E)
595/C/5 Mani Mansion, Vincent Road, Matunga, Bombay 19.

50. M 1323 B. B. Patkar (C)
Prakash, Road No. 3, Shivaji Park, Bombay 23.

51. M 1858 M. S. Phadke (C)
63 Ganesh Baug, 208 Vincent Road, Matunga, Bombay 19.

52. M 841 B. K. R. Prasad (E, Ch)
c/o Cricket Club of India, Brabourne Stadium, Bombay 1.

53. M 1708 N. N. Purandare (C)
Consulting Civil Engineer, 24B, Hamam Street, Fort, Bombay 1.

54. AM 1710 T. Rama Rao (C)
Burmah Shell, G. M. Office, Ballard Estate, Post Box 688, Bombay.

55. AM 3642 G. R. Samant (E)
6 Radha Nivas, Parsi Colony, Opposite Tram Depot, Dadar, Bombay.

56. AM 6690 P. V. Sathe (C)
Executive Engineer, Presidency Division, Fort, Bombay 1.

57. M 1636 C. H. Shah (C)
9 Ayub Mansion, Chandaverker Road, Matunga, Bombay 19.

58. AM 3039 C. Soares (C)
Khan Mansion, 3rd Victoria Cross Lane, Bombay 27.

59. M 1711 R. Srinivasan (M, E)
Commercial Manager, Tata Hydro-Electric Cos., Ltd., Bombay House, Bruce Street, Fort, Bombay 1.

60. M 1159 T. N. Tolani (M)
Director of Technical Education, Elphinstone Technical School Building, Cruickshank Road, Bombay.

61. M 1275 J. N. Vakil (C)
'Mirador', 67 H Warden Road, Bombay 26.

Delhi Centre

1. M 1433 P. R. Ahuja (C)
Chief Engineer, Floods (F.L), Central Water & Power Commission, 4B Mathura Road, Jangpura, New Delhi.

2. AM 4017 F. V. Badami (C)
Development Officer, Ministry of Commerce & Industry, Development Wing, Udyog Bhavan, King Edward Road, New Delhi.

3. M 1880 D. R. Bahl (C)
123 Jorbagh Nursey, New Delhi 3.

4. M 1486 M. L. Bahl (C)
Chif Engineer, Indian Refineries Ltd., 11 Ring Road, Jangpura Extension, New Delhi 14.

5. M 1650 Baleshwar Nath (C)
Member (I & P), Committee on Plan Projects, Planning Commission, Yojana Bhavan, New Delhi 2.

6. M 1750 Col. G. Benjamin (C)
Engineer-in-Chief's Branch, Army Head Quarters, Kashmir House, New Delhi.

7. M 2451 Col. N. S. Bhagat (C)
Engineer-in-Chief's Branch, Army Head Quarters, Kashmir House, New Delhi.

8. AM 3510 N. H. Bhagwani (C)
40/12 East Patelnagar, Upper Floor, New Delhi 12.

9. AM 3105 D. N. Bhargava (E)
Commercial Officer, Delhi State Electricity Board, Chandni Chowk, Delhi.

10. M 1849 M. S. Bhatia (C)
Additional Chief Engineer II, C.P.W.D., Talkatora Barracks, New Delhi.

11. AM 2672 J. R. Bimbrahw (M)
Delhi Polytechnic, Kashmiri Gate, Delhi.

12. AM 4942 Lt.-Col. I. S. Brar (M)
Director of Transportation, Engineer-in-Chief's Branch, Army Head Quarters, P.O., D.H.Q. New Delhi 11.

13. M 1019 Brijmohan Lal (C)
E3/17 East Patelnagar, New Delhi.

14. M 2000 Capt. S. K. Chatterjee (C)
Director of Civil Engineering, Naval Head Quarters, New Delhi 11.

15. M 904 A. N. Chopra (C)
54 Sundernagar, near Purana Qila, New Delhi.

16. M 2355 Brig. B. N. Das (C)
Chief Engineer, Air Force Work, Kashmir House, D.H.Q. P.O., New Delhi.

17. AM 5534 Maj. P. Das Gupta (E)
c/o D.E.M.E., Army Head Quarters, Kashmir House, New Delhi.

18. M 2338 Prof. H. E. Dance (M)
E5 Ring Road, Defence Colony, New Delhi.

19. M 2373 Col. O. P. Datta (C)
Director of Works (Air), Army Head Quarters, Kashmir House, New Delhi.

20. M 2484 Maj. J. T. R. David (E)
Staff Officer, Directorate General of Works, Kashmir House, D.H.Q. P.O., New Delhi.

21. M 1273 Devi Dayal (C)
34/3 Hanuman Road, New Delhi.

22. AM 3403 B. S. Dhami (M. E.)
Superintending Engineer, Directorate General of Works, Army Head Quarters, Kashmir House, New Delhi.

23. M 1483 R. D. Dhir (C)
Director (Hydrology), Central Water & Power Commission, Curzon Road, New Delhi.

24. M 1101 S. K. Dutt (C)
Consulting Engineer, 28/59 Rohtak Road, New Delhi 5.

25. M 747 S. N. Dutt (C)
24/39 Chanakyapuri, New Delhi.

26. M 1271 K. K. Framji (C)
Chief Engineer & Joint Secretary, Ministry of Irrigation and Power, 224 Udyog Bhavan, New Delhi.

27. M 1800 Lt.-Col. G. C. Gautam (E)
Engineer-in-Chief's Branch, Army Head Quarters, D.H.Q. P.O., New Delhi.

28. M 2555 Col. N. B. Grant (C)
Controller Engineering (R & D), Engineering-in-Chief's Branch, Kashmir House, New Delhi.

29. M 1513 L. S. Gupta (C)
15A/21 Western Extension Area, Karolbagh, New Delhi 5.

30. AM 2547 S. L. Gupta (E)
Electrical Engineer (M), N.D.M.C., New Delhi.

31. AM 4923 Gurbaksh Singh (M)
2C Press Block, 55 Alipore Road, Behind Old Secretariat, Civil Lines, Delhi 6.

32. AM 6197 Maj. V. P. Hans (C)
G. E. (Project) Palam, Gurgaon Road, Delhi Cantonment 10.

33. M 2230 S. S. Hora (C)
23 Windsor Mansions, Janpath Lane, New Delhi 1.

34. M 1577 Indra Sen (C)
Retired Superintending Engineer, 35 Jorbagh Nursery, New Delhi 3.

35. M 1029 P. V. S. Iyengar (M)
Chartered Engineer & Industrial Consultant, 11A/25 Western Extension Area, Karolbagh, New Delhi 5.

36. M 1164 Dr. R. K. N. Iyengar (C)
Deputy Director, Central Road Research Institute, P.O. Central Road Research Institute, Okhla, New Delhi.

37. M 1615 H. C. Kalra (C)
35 Mannagar, New Delhi.

38. M 1809 Dr. P. K. Kapre (E)
Director & Industrial Adviser, Philips Electrical Co. (India), Ltd., Asaf Ali Road, New Delhi.

39. M 1448 S. N. Kapur (C)
Member, Irrigation & Power Team, Committee on Plan Projects, Yojana Bhavan, Parliament Street, New Delhi 1.

40. AM 5306 Maj. K. M. Kini (M, E)
c/o. The State Bank of India, Parliament Street, New Delhi 1.

41. M 477 A. G. Khan (M, E)
Deputy Director General, Disposal, Department of Industries & Supplies, Block No. 4, Shahjahan Road, New Delhi.

42. AM 3549 G. S. Kulashrestha (M, E)
Deputy Director of Supplies, Directorate General of Supplies & Disposals, Parliament Street, New Delhi 1.

43. M 1293 S. S. Kumar (C, E)
Chairman, Central Water & Power Commission, Shahjahan Road, New Delhi.

44. M 2390 Col. R. N. Kumar (M, E)
Army Head Quarters, Engineer-in-Chief's Branch, Kashmir House, D.H.Q. P.O., New Delhi.

45. M 2025 Maj.-Gen. R. A. Loomba (C)
Director-General of Works, Kashmir House, New Delhi.

46. M 2108 Dr. S. P. Luthra (M, E)
Head of Engineering Department, Delhi Polytechnic, Kashmiri Gate, Delhi 6.

47. M 1519 C. P. Malik (C)
Director, National Buildings Organization, C1/16 Humayun Road, New Delhi.

48. M 1031 M. P. Mathrani (C)
16/39 Diplomatic Enclave, New Delhi.

49. AM 2288 R. S. Mehandru (C)
S.O.I. (Planning), Engineer-in-Chief's Branch, Army Head Quarters, D.H.Q. P.O., New Delhi 11.

50. M 920 T. R. Mehandru (C)
Registered Architect and Chartered Engineer, 14 Asaf Ali Road, Ajmeri Gate Extension, New Delhi.

51. M 1564 Dr. S. R. Mehra (C)
Director, Central Road Research Institute, P.O. Central Road Research Institute, Okhla, New Delhi.

52. AM 1367 J. P. Mehrotra (E)
c/o Indian Investment Centre, National Insurance Building, Parliament Street, New Delhi.

53. M 1411 D. Mehta (C)
N1 Ring Road, N.D.S.E.1, New Delhi 3.

54 M 1987 J. P. Mital (C)
Adviser (Irrigation) to Government of India, Ministry of Community Development Corporation, 35/16 Ferozeshah Road, New Delhi.

55. M 1257 M. D. Mithal (C)
G66 Connaught Circus, New Delhi.

56. M 1978 J. N. Moodgil (M, E)
Planning Officer, College of Engineering & Technology, Houz Khas, Delhi.

57. M 1016 B. S. Nag (C)
Adviser (Irrigation & Power), Planning Commission, Udyog Bhavan, New Delhi 2.

58. M 2323 Col. B. T. Nagrani (M)
Directorate-General Border Roads, Kashmir House, D.H.Q., P.O. New Delhi.

59. M 1526 M. L. Nanda (C)
Additional Chief Engineer (C), Central Public Works Department, L. Block, New Delhi.

60 AM 2907 B. Nanjundiah (E)
c/o Burn & Co., Ltd., Reyrolle Agency, 40-42 Janpath, New Delhi.

61. AM 3634 U. L. Nayak (M, E)
Lecturer, Engineering Department, Delhi Polytechnic, Kashmiri Gate, Delhi.

62. M 2180 Wg.-Cdr. V. G. Nayanar (M, E)
9 Air Command Quarters, Gurgaon Road, Delhi 10.

63. M 2155 P. S. Padmanabhan (C)
c/o Sri R. Rangachari, Deputy Director, Consultants Division, Ministry of Irrigation & Power, Udyog Bhavan, New Delhi 11.

64. AM 3969 M. M. Patel (C)
Deputy Superintendent, Water Works, Civil Lines, Delhi 6

65. AM 3692 Prithvi Nath (E)
D11 300 Vinay Marg, Diplomatic Enclave, New Delhi 11

66. AM 2261 M. L. Raheja (C)
Deputy Chief Engineer, Air Force Works, Kashmir House, New Delhi.

67. M 1385 Brig. K. B. Rai (C)
c/o Delhi Gymkhana, Delhi.

68. M 1940 K. B. Rao (E)
26 Wellesley Road, New Delhi.

69. M 2187 Brig. K. K. Rao (C, M)
Inspector E.M.E, Army Head Quarters, D.H.Q., P.O. New Delhi

70. M 1290 Dr. K. L. Rao (C)
4 Humayun Road, New Delhi.

71. AM 1296 K. S. Rastogi (C)
Chartered Engineer & Builder, 17 Park Area, Karolbagh, New Delhi 5.

72. AM 3416 Brig. J. R. Samson (M, E)
Director of Armament, Ministry of Defence, Defence Research & Development Organization, D.H.Q., P.O. New Delhi 11.

73. M 1298 K. D. Sanwal (C)
Director (Irrigation). Planning Commission, Room No. 222, Yojana Bhavan, Parliament Street, New Delhi.

74. M 1960 Sarup Singh (C)
5 Wellesley Road, New Delhi 11.

75. M 1350 A. B. Sen (C)
Superintending Engineer, Eastern Electrical Circle, C.P.W.D., G Block, New Delhi.

76. M 2097 Col. C. L. Seshagiri (M)
Commandant, 505 Army Base Workshop, Delhi Cantonment 10.

77. M 1228 G. R. Sethi (C)
Retired Superintending Engineer, C.P.W.D., 2B Mathura Road, Jangpura, New Delhi.

78. AM 3293 B. S. Sharma (C)
6/18 Khirkee Gate, Shahdara, Delhi 32.

79. M 756 Dr. Shiv Narayan (M, E)
V/2547 Naiwara, Chawri Bazar, Delhi 6.

80. M 1774 Shri Krishna (C)
C11/1 Wellesley Road, New Delhi 11.

81. M 2010 G. B. Singh (C)
2 Rajpur Road, Delhi.

82. M 858 Siri Ram (C)
6/15 East Patelnagar, New Delhi.

83. M 2138 P. N. Soman (C)
Bombay Life Building, N 108 Connaught Circus, New Delhi.

84. AM 1869 V. K. Srivastava (E)
Electrical Engineer, N.D.M.C., New Delhi.

85. M 1551 K. R. Sud (C)
126 Golf Lines, New Delhi.

86. AM 3212 Brig. K. Sundaram (C)
Kashmir House, New Delhi 11.

87. AM 3581 Swami Dial (C)
Superintending Engineer, C.P.W.D. 2nd Circle, G Block, New Delhi 1.

88. M 2151 V. B. Tawadey (C)
S.O.I. (Planning), Chief Engineer's Office, Air Force Works, Kashmir House, New Delhi 11.

89. AM 1336 S. S. Varma (C)
Deputy Chief Engineer (Bridges), Northern Railway, Baroda House, New Delhi.

90. M 1388 S. R. Vasudev (C)
33 Sundarnagar, 1st Floor, New Delhi.

91. AM 1268 V. Venkataramayya (C)
Director, Civil Engineering, Railway Board, Ministry of Railways, North Block, New Delhi.

92. M 1712 A. Venkateiah (M)
Development Officer, Ministry of Commerce & Industry, Udyog Bhavan, New Delhi.

93. M 2115 V. Venugopalan (E)
Director (Trans), Central Water & Power Commission, (Power Wing), 127 Jorbagh, New Delhi 3.

94. M 1694 Dr. L. C. Verman (E)
Director, Indian Standards Institution, Manak Bhavan, 9 Mathura Road, New Delhi.

95. M 1840 K. L. Vij (M, E)
Director (Hydro-Electric), Central Water & Power Commission, Shahjahan Road, New Delhi.

96. AM 6148 S. N. Vinze (E)
Deputy Director (Hydro-Electric), Central Water & Power Commission, Shahjahan Road, New Delhi 2.

97. AM 7048 Dr. H. C. Visvesvaraya (C)
Deputy Director (Buildings), Indian Standards Institution, Manak Bhavan, 9 Mathura Road, New Delhi 1.

98. M 2103 Col. G. S. Viswanath (C)
Director, Engineer Stores & Plant, Engineer-in-Chief's Branch, Army Head Quarters, D.H.Q., P.O. New Delhi 11.

99. M 1561 Maj.-Gen. S. P. Vohra (M, E)
1 Kushak Road, New Delhi.

100. M 1149 B. S. Wadhera (C)
4/14 Patelnagar East, New Delhi 12.

101. M 1204 Yadav Mohan (C)
Member, Central Water & Power Commission, 45 Lodi Estate, New Delhi 3.

102. M 2112 M. V. Yogi (C)
c/o D. G. W. (Army & Fys), Army Head Quarters, Kashmir House, New Delhi 11.

Gujarat Centre

1. M 1913 D. C. Bhardwaj (M, E)
Generating Station, Sabarmati, Ahmedabad 5.

2. M 1808 Prof. R. H. Chokhavatia (C)
Professor of Civil Engineering, Birla Vishwakarma Mahavidyalaya, Vallabh Vidyanagar, *via* Anand, District Kaira.

3. M 1851 B. K. Choksi (C)
Superintending Engineer, Design Circle (R & B), P.W.D., Workshop Building, Sachivalaya, Ahmedabad 15.

4. AM 9041 H. G. Daryani (C)
Principal, Gandhidham Civil Engineering Institute, Adipur, Kutch.

5. AM 6945 Dr. M. A. Date (M, E)
Assistant Professor in Electrical Engineering, Vallabh Vidyanagar, District Kaira.

6 AM 1528 D. R. Desai (C)
Ramnivas, Nanabhai Road, Near Basant Hall, Surat.

7. M 1909 G. S. Desai (C)
21 Shanti Sadan, C. H. Society, Ellis Bridge, Ahmedabad 6.

8. M 1296 R. P. Desai (E)
Navyug Bungalow, S.R.P. Compound, Opposite Motibagh Palace Grounds, Baroda.

9. M 2240 R. V. Desai (C)
Engineer & Contractor, Station Road, Navsari.

10 M 2039 T. A. Desai (M, E)
Principal, S. V. Regional College of Engineering & Technology, Majura Gate, Surat.

11 M 1579 S. S. Divatia (C)
40 Parimal Society, Ellis Bridge, Ahmedabad 6.

12. AM 2001 N. W. Goghari (C)
Three Bungalows, Maharashtra Society, Ahmedabad 6.

13. AM 6363 H. S. Jain (M, E)
Electrical Department, L.D. College of Engineering, Ahmedabad 9.

14. AM 6285 B. M. Jani (M)
Staff Bungalow, Vallabh Vidyanagar, District Kaira

15. AM 3180 P. S. Kalwachwala (E)
Principal, Sir Bhavsinhji Polytechnic, Bhavnagar

16. M 1432 Prof. K. V. Kardile (M, E)
Professor of Electrical Engineering, Birla Vishwakarma Mahavidyalaya, Vallabh Vidyanagar, *via* Anand, District Kaira.

17. AM 1852 S. K. Katrak (C)
Director of Technical Education, L.D. College of Engineering Buildings, Ahmedabad 9.

18. M 1516 Prof. C. H. Khadilkar (C)
Faculty of Technology & Engineering, M.S. University, Baroda.

19. AM 1211 G. J. Kulkarni (C)
Principal, L. Engineering College, Morvi.

20. AM 6329 S. B. Kumta (C)
Principal, Kilachand Devchand Polytechnic, Patan

21. M 2122 P. J. Madan (C)
14 Alkapuri, Baroda.

22. M 1791 J. P. Naegamvala (C)
Director, Engineer Research Institute, New Kathi Building, Baroda.

23. AM 998 H. M. Pancholy (C)
13 Saraswati Society, P.O. Anandnagar, Ahmedabad 7

24. AM 6944 Dr. N. C. Pandya (M, E)
Professors Quarters, Vallabh Vidyanagar, *via* Anand, District Kaira.

25. AM 846 R. M. Parikh (C)
Sharad Purnima Bungalow, Patidar C.H. Society, Ellis Bridge, Ahmedabad 6.

26. AM 8783 A. B. Patel (C)
Assistant Engineer, Ahmedabad Municipal Corporation, 9 Chandra Colony, Ellis Bridge, Ahmedabad 6.

27. M 1748 A. N. Patel (C)
Plot No. 4, Patidar Society, Ellis Bridge, Ahmedabad 6.

28. AM 2595 N. C. Patel (C)
Development Commissioner, Kandla Port, Post Box No. 53, Gandhidham, Kutch.

29. AM 6321 Prof. O. H. Patel (C)
Professor & Head of Civil Engineering Department, Faculty of Technology, M.S. University, Baroda.

30. AM 9224 S. C. Rangwala (C)
584 Thengawada, Raipur, Ahmedabad 1.

31. AM 4068 N. G. Rathod (C)
Executive Engineer, P.W.D., Dantiwala Canal Division, Palanpur.

32. AM 3717 P. A. Rawal (C)
261 Gunwali pole, Vadigam, Dariapur, Ahmedabad 1.

33. AM 7076 Dr. C. S. Shah (M, E)
Assistant Professor in Mechanical Engineering, Vallabh Vidyanagar, District Kaira.

34. M 1997 J. M. Shah (M, E)
Faculty of Technology & Engineering, Baroda.

35. AM 4701 M. M. Shah (M, E)
Calico Mills, Ahmedabad.

36. AM 9991 V. N. Soni (C)
F10 Gujarat Government Quarters, Near Sachivalaya, Opposite C. N. Vidyalaya, Ambavadi, Ahmedabad 6.

37. AM 10050 N. C. Sonpal (E)
Electrical Engineering Department, L.D. College of Engineering, Ahmedabad 9.

38. AM 4539 K. Subrahmanyam (M)
Ahmedabad Textile Industries Research Association, Navrangpura Ahmedabad 9.

39. M 2142 R. R. Sukhrani (C)
Superintending Engineer (General), Kandla Port Organization, P.O. Gandhidham, Kutch.

40. AM 9178 R. K. Vip (M)
Deputy Director (Production), P.T.C. Small Scale Industries Corporation, Udhyognagar, Rajkot.

41. M 1923 P. K. Vora (C)
Superintending Engineer, A6 Government Officers Plots, Ahmedabad 6.

42. M 2185 M. S. Yajnik (M, E)
'Suvas,' Bhaktinagar Society, Rajkot.

Jammu and Kashmir

1. M 1929 B. N. Mengi (C)
Chief Engineer, Irrigation Department, Jammu Tawi.

2. M 2036 J. B. Nanda (C)
Superintending Engineer, Ram Munshi Bagh, Srinagar.

3. M 2164 R. L. Sharma (M, E)
c/o. Superintending Engineers Office, Electricity Project & Planning Circle, Jammu.

4. M 1445 V. D. Zadoo (C)
Consulting Engineer, Exchange Road, Srinagar.

Kerala Centre

1. AM 7214 K. C. Alexander (C)
Manjalloor House, Kuravankonam, P.O. Kawdiyar, Trivandrum 3.

2. M 2129 T. Balakrishna Menon (C)
Chief Engineer, Public Health Engineering Department, Trivandrum 1.

3. M 2018 A. K. Chacko (C)
Retired Chief Engineer, Theckumood, Kesava Bilas, Trivandrum 1.

4. M 2284 K. C. Chacko (C)
Director of Technical Education, Trivandrum.

5. M 2120 O. J. Cheriyan (C)
Superintending Engineer, Pamba Hydro-Electric Project, Kottayam.

6. AM 2948 K. E. Eapen (C)
Chief Engineer, Public Health Engineering, Trivandrum.

7. M 2002 Prof. P. C. Eapen (M)
Principal, N. S. S. College of Engineering, Palghat 1.

8. M 2610 T. C. George (C)
Champaka Vilas, Poonen Road, Trivandrum.

9. AM 1829 V. V. Gopalakrishna Ayyar (C)
Chief Engineer (Roads & Buildings), Trivandrum.

10. M 1958 Dr. M. V. Kesava Rao (E)
Principal, College of Engineering, Trivandrum.

11. M 2186 A. J. Joseph (C)
Deputy Chief Engineer, (General & Irrigation), P.W.D., Trivandrum.

12. M 2043 T. P. Kuttiammu (C)
Chief Engineer (General & Irrigation), P.W.D., Trivandrum.

13. AM 7073 K. R. Madhavan Nair (C)
University Engineer, University of Kerala, Trivandrum.

14. M 1826 A. G. Menon (M)
Additional Chief Secretary to the Government of Kerala, Trivandrum.

15. M 2359 V. G. G. Nayar (E)
General Manager, Aluminium Industries Ltd., Kundara.

16. M 1946 A. O. Oommen (E)
Chief Engineer and Technical Member, Kerala State Electricity Board, Trivandrum 1.

17. M 2079 C. S. Padmanabha Aiyar (C)
Additional Chief Engineer (Irrigation), Trivandrum 1.

18. M 1330 S. K. Panikkar (C)
Novarangam, Pattom, Trivandrum.

19. M 1963 G. Purushothaman Pillai (M, E)
Chief Operation Engineer, Kerala State Electricity Board, Trivandrum.

20. M 1635 Prof. S. Rajaraman (C)
Director of Technical Education, Government of Kerala, Trivandrum.

21. M 1496 P. G. Raman Nair (C)
Avuthodu House, Nathiattu Kunnamu, P.O. Parur, District Trichur.

22. M 1437 S. Ramchandran (C)
Chief Engineer, Public Health Engineering Department, Trivandrum 1.

23. M 2003 V. Ranganathan (C)
Chief Engineer (Construction), Kerala State Electricity Board, Trivandrum 1.

24. M 926 S. Varadaraja Sarma (C)
Retired Superintending Engineer, P.O. Pattom Place, Trivandrum 4.

25. AM 6926 K. G. Seshan (M, E)
Assistnat Engineer, Kerala State Electricity Board, 413 Chenthittai Street, Trivandrum.

26. AM 6663 M. P. Subramonia Ayyar (C)
Assistant Engineer, P.W.D., Padma Vishak, College Lane, Trivandrum 1.

27. M 1731 C. V. Venkateswaran (C)
Chief Engineer, Cochin Harbour, Cochin 3.

28. AM 2745 Prof. K. Venkitaraman (E)
Professor of Electrical Engineering, College of Engineering, Trivandrum 1.

Madhya Pradesh Centre

1. AM 6496 Lt.-Col. R. L. Anand (C)
c/o Commander Works Engineers, Supply Road, Jabalpur Cantonment.

2. M 2040 N. D. M. Appa (E)
Deputy Chief Engineer, Heavy Electricals Ltd., Post Box No. 46, Bhopal.

3. AM 4293 P. R. Aramadhu (C)
Executive Engineer, P.W.D., S-11-27, South T.T. Nagar, Bhopal.

4. M 2443 Maj. L. R. Baronia (M, E)
General Manager, M.P. State Transport Service (C.P.T.S.), Residency Road, Jabalpur.

5. AM 4459 S. Beedkar (M)
Principal, Sardar Vallabhbhai Polytechnic, Bhopal.

6. M 1715 M. F. Beg (C)
Chief Engineer, Heavy Electricals Ltd., Bhopal.

7. AM 5470 S. B. S. Bhambroy (C)
Executive Engineer, Dandakaranya Project, P.O. Kondagaon, District, Bastar.

8. M 908 N. K. Bhonsale (C)
5 Mahadoji Park, Gwalior.

9. AM 8210 B. Chawla (C)
Garrison Engineer (East), M.E.S., Jabalpur 6.

10. AM 3153 M. O. Danani (M, E)
General Manager, Gwalior Engineering Works, Gwalior.

11. M 2628 S. K. Das (E)
Joint Director of Public Instruction (Technical), Government of Madhya Pradesh, Bhopal.

12. M 1860 N. R. Das Gupta (M, E)
Head of Electrical & Mechanical Engineering Department, G. S. T. Institute, Indore.

13. AM 5745 R. A. Deshpande (E)
Government Engineering College Colony, Jabalpur.

14. AM 4115 M. Dinkar (E)
Electrical Engineer, c/o Chief Power Engineer, Bhilai Steel Project, Bhilai.

15. M 2400 Dr. V. M. Dokras (Ch)
Principal, Government Engineering College, Jabalpur.

16. M 1287 Prof. N. N. Ghosh Dastidar (M, E)
Principal, Madhav Engineering College, Residency, Gwalior.

17. AM 4457 V. D. Gupta (M, E)
Senior Assistant Professor, Government Engineering College, Jabalpur

18. AM 4514 T. C. Gurbaxani (C)
Executive Engineer, Indore Division No. 1, P.W.D., (B & R), Indore.

19. M 1832 S. G. Inamdar (C)
Deputy Chief Engineer, P.W.D. (Irrigation), Irrigation Colony, Civil Lines, Raipur.

20. M 2099 D. R. Karnad (M, E)
Personnel Officer, Madhya Pradesh Electricity Board, Jabalpur.

21. AM 5112 R. K. Keshava Narayan (C)
Professor of Civil Engineering, Madhav Engineering College, Gwalior.

22. AM 4088 N. Kunhiraman (C)
P.A. to Engineer-in-Chief (Construction), South-Eastern Railway Mahendragarh, District Surguja.

23. M 1998 Prof. A. Lakshmanaswamy (C)
Professor and Head of Civil Engineering Department, Government Engineering College, Jabalpur.

24. AM 5779 J. C. Malhotra (MM)
Burhar Colliery, P.O. Dhanpuri, *via* Burhar.

25. M 2290 Dr. M. Manohar (C)
Professor & Head of Civil Engineering Department, Moulana Azad College of Technology, Bhopal.

26. M 1370 K. R. Minocha (E)
Technical Member, Madhya Pradesh Electricity Board, Rampur, Jabalpur.

27. M 1779 L. N. Misra (M, E)
Chief Mechanical Engineer, Bhilai Steel Plant, Bhilai 1

28. AM 3276 B. R. Raghavendra Rao (M)
Chief Training Instructor, Heavy Electricals Ltd., Govindpur Colony, Bhopal

29. M 2329 K. S. Rane (E)
Madhav Engineering College, Residency, Gwalior.

30. AM 3205 B. S. Rathore (M, E)
Executive Engineer, Chambal Project, Transmission and Grid Substation Division II, Jyotinagar, Ujjain.

31. M 1736 S. N. Razdan (E)
Chief Engineer, Madhya Pradesh Electricity Board, Rampur, Jabalpur.

32.	AM	4515	S. R. Sabhlok (MM) Manager, Central India Coalfields Ltd., Pure Chirimiri Colliery, P.O. Chirimiri.
33.	M	2505	V. V. Sarwate (E) 1958 Wright Town, Jabalpur 1.
34.	AM	5131	M. G. Shah (C) Professor and Head of Civil Department, Karad Engineering College, Karad.
35.	M	2194	N. N. Shah (C) Public Health Engineer, Bhopal.
36.	AM	844	D. S. Sharangpani (E) Shanti Kunj, 3 North Tukoganj, Indore
37.	AM	5593	S. C. Sharma (C) Executive Engineer, Public Health Division, Ujjain
38.	M	1151	H. N. Shrivastava (E, T) 272 Napier Town, Naveen Vidya Bhawan Marg, Jabalpur 1.
39.	M	2366	M. L. Sood (C) Chief Engineer Irrigation, Raipur
40.	M	1642	S. S. Swaminathan (C) Superintending Engineer (Civil), Madhya Pradesh Electricity Board, Rampur, Jabalpur.
41.	AM	2511	G. P. Tiwari (M) Chief Inspector of Boilers, Baxibad, Indore.
42.	AM	1820	K. N. Tiwari (M, E) Chief Engineer, Jiyajeerao Cotton Mills Ltd., Gwalior.
43.	M	2478	P. C. Vasandani (M, E) G. S. Technological Institute, Indore
44.	AM	5961	D. Venkata Rao (C) Executive Engineer, P.W.D. (B & R), Satpura Division, Chhindwara
45.	AM	4215	A. P. Verkhedkar (M) Chief Inspector of Factories, Government of Madhya Pradesh, Indore City.
46	M	1706	Prof. P. C. Wadhwani (M, E) Government College of Engineering & Technology, Raipur

Madras Centre

1.	M	1529	J. G. Abraham (C) 60 Shenoynagar, Madras 30.
2.	AM	4102	K. Achuthan Nair (M) Mechanical Department, Government College of Technology, Lawley Road, Coimbatore 3.
3	M	1133	U. Ananda Rao (C) Chief Engineer, P.W.D., 5 Bhagirathiammal Street, Thyagarayanagar, Madras 17.
4.	M	1645	V. P. Appadurai (E) Chief Engineer, Madras Electricity Department, 157 Mount Road, Madras 2.
5 -	M	1911	Prof. G. R. Damodaran (M, E) Principal, P.S.G. College of Technology, P.O. Peelamedu, Coimbatore.

6.	M	1543	L. Ekambram (E) Retired Chief Electrical Inspector, 78 Sullivan Garden Road, Madras 4.
7.	M	1622	J. M. Frederick (C) Retired Chief Engineer, P.W.D., 5 Gengu Reddy Road, Egmore, Madras 8.
8.	AM	3658	G. S. Gangadharan (C) Engineer & Contractor, 6/48 Tatabad, Coimbatore.
9.	AM	6978	B. Gopalan (E) Principal, Government Polytechnic, Pondicherry.
10.	M	2379	Prof. V. S. Jayaraman (M, Ch) 44 St. Mary's Road, Madras 18.
11.	M	1480	N. S. Krishnaswamy (C) Principal, Government College of Technology, Lawley Road, Coimbatore 3.
12.	M	1794	G. R. Oliver (C) Superintending Engineer, P.W.D., Gladrich, Palace Road, Nagercoil.
13.	M	1680	M. Meeran (C) Engineer, Corporation of Madras, 63 Shenoynagar, Madras 30.
14.	M	1685	S. L. N. Moorthi (C) 26 Model House Road, C.I.T. Nagar, Madras 17.
15.	AM	5651	N. G. Nagesh (MM) Manager, National Small Industries Corporation (Madras) Private Ltd., 15 Mowbrays Road, Madras 18.
16.	M	1421	T. S. Narayana Iyer (M) Mithila, 14 Lakshmipuram Road, Madras 14.
17.	M	1251	A. R. Narayana Rao (M, E) Retired Chief Operations Engineer, Madras Electricity Department, Ramana Nivas, 2 Crescent Road, Gandhinagar, Adyar, Madras 20.
18.	M	1299	S. C. Nayak (C) Chief Engineer (Highways), Chepauk, Madras 5.
19.	AM	4816	Prof. S. Panchanathan (C) Professor of Soil Mechanics & Foundation Engineering, College of Engineering, Guindy, Madras 25.
20.	M	2201	N. R. Pavri (M, E) Branch Manager, Voltas Ltd., 115/116 Armenian Street, Madras 1.
21.	M	2387	O. T. Raghavan (C) Water Works Engineer, Corporation of Madras, Ripon Buildings, Madras 3.
22.	M	1939	Prof. P. Rajagopal Pillai (E) Principal, College of Engineering, Guindy, Madras 25.
23.	M	879	V. Ramaiya (C) 75/7 Veeraperumal Koil Street, Mylapore, Madras 4.
24.	M	1576	H. K. Ramaswami (E) Director, Seshasayee Brothers Private Ltd., 1 Alexandria Road, Power House, Post Box No. 67, Tiruchirapalli 1.
25.	M	2135	Prof. P. R. Ramaswami (C) Professor of Civil Engineering, Government College of Technology, Lawley Road, Coimbatore 3.

26. M 1697 R. N. Roy (M, E)
Dhun Building, 175/1 Mount Road, Madras 2.

27. AM 3895 S. Sankaran (E)
Superintending Engineer, South Madras Electric Supply Corporation Ltd., Tiruchirapalli.

28. M 1514 M. Sivaraman (M)
45 Spur Tank Road, Chetput, Madras 31.

29. M 1666 Prof. A. Srinivasan (E)
Professor of Electrical Engineering, College of Engineering, Guindy, Madras 25.

30. M 1830 K. N. Srinivasan (C)
Chief Engineer, Madras Port Trust, Madras.

31. M 1807 P. S. Subramaniam (C)
Director, Gannon Dunkerley & Co. (Madras), Ltd., 14 Boag Road, Madras 17.

32. M 1709 G. Venkataraman (C)
Retired Chief Construction Engineer, Plot No. 40, East Abhiramapuram Extension, Mylapore, Madras 4.

Mysore Centre

1. M 1991 M. R. Arya (E)
240 5th Main Road, Chamarajpet, Bangalore 18.

2. AM 5768 Y. V. Aswathanarayana Rao (E)
109D VII Block, Jayanagar, Bangalore 11.

3. M 1865 J. N. Athavale (C)
Principal, K. H. Kabbur Institute of Engineering, Dharwar.

4. AM 6001 S. L. Bulbule (M)
B. V. B. College of Engineering and Technology, Hubli.

5. M 1806 L. Doraiswamy (M, E)
Lakshminilayam, Upper Pipe Line Road, Seshadripuram, Bangalore.

6. AM 3242 B. P. Gopalakrishna (M)
Principal, B. D. T. College of Engineering, Davanagere.

7. M 1562 Prof. N. S. Govinda Rao (C)
Professor of Hydraulics & Civil Engineering, Power Engineering Department, Indian Institute of Science, Bangalore 3.

8. AM 3422 K. V. Gundu Rao (M)
Assistant Professor of Mechanical Engineering, College of Engineering, Bangalore 1.

9. M 1023 R. G. Islur (C)
Retired Executive Engineer, P.W.D., 49 Saraswatpur, Dharwar.

10. AM 8127 D. V. S. Iyer (C)
Lecturer in Civil Engineering, B. V. B. College of Engineering and Technology, Hubli.

11. AM 5865 S. Krishna Setty (M)
Head of Mechanical Engineering Department, Karnataka Regional Engineering College, Surathkal (S.K.).

12. AM 2822 S. Krishnaswamy Rao (M, E)
53rd Main Road, Mysore 2.

13. AM 3865 Lt.-Col. N. M. Mazumdar (E)
515 Army Base Workshop, Bangalore 8.

14. AM 2109 Prof. B. R. Narayana Iyengar (M)
Professor of Mechanical Engineering, College of Engineering, Bangalore 1.

15. M 1552 T. S. Narayana Rao (C)
Consulting Architect & Engineer, 9 Mahatma Gandhi Road, Bangalore 1.

16. M 2044 B. V. Patankar (M)
407 6th Main Road, Malleswaram, Bangalore 3

17. AM 3130 Maj. A. Rajah (E)
Electronics & Research Development Establishment, High Grounds, Bangalore 1.

18. M 1945 Prof. H. N. Ramachandra Rao (E)
Professor of Power Engineering, Indian Institute of Science, Bangalore 12.

19. M 1705 P. M. Reddy (M)
c/o Hindustan Aircraft Ltd., Engine Division, Bangalore

20. M 2136 K. Seetharamaiah (C, E)
Assistant Professor, Power Engineering Department, Indian Institute of Science, Bangalore 3.

21. M 1775 A. Seshappa (C)
Principal, National Institute of Engineering, Mysore.

22. M 1434 C. N. Shama Rao (M)
Retired Superintending Engineer, 1 Ranga Rao Road, Shankarapuram, Bangalore 4.

23. AM 7453 A. Shariff (M)
149 2nd Block, Jayanagar, Bangalore 4.

24. AM 6833 H. S. Shivaswamy (C)
Head of Applied Mechanics Department, B.V.B. College of Engineering and Technology, Hubli.

25. AM 1808 R. Srinivasan (C)
Professor and Head of Civil Engineering Department, Manipal Engineering College, Manipal, South Kanara.

26. AM 5245 S. Srinivasan (C)
Badreesa Nilaya, 2847/13A 3rd Main Road, Jayanagar, Mysore.

27. AM 7119 A. V. Subba Rao (M)
37 N. R. Colony, Bangalore 4.

28 AM 2534 S. K. Subba Rao (C)
Executive Engineer, Minor Irrigation Projects Division, Raichur, Mysore

29. AM 7863 Maj. T. R. K. Sundaram (M, E)
L.R.D.E., 9/2 Palace Road, Bangalore 1.

Orissa Centre

1. AM 7817 B. Behera (C)
University Engineering College, P.O. Burla, Hirakud Colony, District Sambalpur.

2 M 2376 S. S. Behera (C)
Additional Chief Engineer (Roads & Buildings), P.O. New Capital, Bhubaneswar.

3. M 2277 K. C. Das (C)
Superintending Engineer, Eastern Circle, Cuttack 1

4. AM 9000 N. K. Das (E)
Executive Engineer (Electrical), General Electrical Division, Bolangir.

5. AM 4043 P. C. Das (C)
Superintending Engineer, North Circle, Burla.

6. M 1134 Jagmohan (C)
Superintending Engineer (Plant), Hindustan Steel Ltd., Rourkela 1.

7. AM 2177 M. K. Lawyer (M, E)
3/5 Senior Officer's Bungalow, Sector IV, Rourkela 2.

8. M 1419 B. R. Malhotra (C)
Chief Engineer, Rourkela Steel Project, Rourkela.

9. AM 9362 U. N. Misra (C)
Principal, Berhampur Engineering School, Berhampur, Ganjam.

10. AM 5466 S. M. Panda (M, E)
Principal, Industrial Training Institute, Berhampur, Ganjam.

11. AM 4163 B. K. Patnaik (M, E)
Deputy Chief Inspector of Factories & Boilers, Cuttack.

12. AM 8021 J. M. Patnaik (E)
Assistant to Chief Engineer (Electricity), Puri.

13. AM 7646 V. Prakash (M)
Superintendent of Training, Hindustan Steel Ltd., Rourkela 1.

14. M 1301 B. Prasad (M, E)
Principal, University Engineering College, Burla.

15. M 855 G. P. Roy (C)
Chartered Engineer, Nari Seba Sangha Road, Puri.

16. M 2303 A. Shankaran (E)
Superintending Engineer, Electrical Circle, Hirakud Dam Project, P.O. Hirakud Colony, District Sambalpur.

Nagpur Centre

1. M 871 F. C. Bulsara (M, E)
'Sherouf', 483 New Colony, Nagpur.

2. M 1885 H. G. Chaoji (M, E)
Dharampeth, Nagpur.

3. M 1497 A. De Souza (C)
Principal, Regional Engineering College, Nagpur 1.

4. AM 2533 S. V. Garde (C)
Engineer & Contractor, Osmanpura, New Colony, Aurangabad.

5. M 2243 Y. K. Ghanekar (C)
Trust Engineer, Wasalwars Bungalow, North Ambazari Road, Dharampeth, Nagpur 1.

6. AM 5164 K. S. Guha (C)
District Engineer, South-Eastern Railway, Nagpur.

7. M 1886 J. C. Karkaria (C)
Empress Mills Bungalow, Sir Bezonji Mehta Road, Nagpur 2.

8. M 1389 R. W. Mavlankar (C)
Utakarsha, Khare Town, Nagpur 1.

9. AM 5530 A. A. Menon (C)
SO III Planning, Office of the D.C.E. (Indep), Bhandara Project, A.E.I. Building, Nagpur.

10. AM 7979 V. A. Paranjpe (C)
Executive Engineer, Bor Project Division, Mount Road, Nagpur.

11. AM 2857 V. G. Ratnaparkhi (C)
Executive Engineer, Power House Construction, B. S. Electricity Board, P.O. Paras, District Akola.

12. M 1399 A. R. Vazifdar (E)
Rustom Villa, Victoria Road, Civil Lines, Nagpur.

Poona Centre

1. AM 2026 P. S. Abhyankar (C)
Walchand College of Engineering, Sangli.

2. M 2234 B. P. Agarwal (M, E)
Chief Engineer, Maharashtra Sugar Mills Ltd., P.O. Tilaknagar, District Ahmednagar.

3. AM 2470 G. M. Apte (C)
40/27 Bhonde Colony, Karve Road, Poona 2.

4. AM 3846 M. P. Apte (C)
1226/6 Shivajinagar, Poona 4.

5. AM 1437 V. R. Bhinge (C)
Engineer & Contractor, Plot No. 8, Mira Road, Sangli.

6. AM 5325 Lt.-Col. J. V. P. Braganza (C, M)
14 Kahun Road, Poona 1.

7. AM 4902 S. K. Chatterjee (E)
Design Office, T.D.E. (V), Ahmednagar.

8. AM 4700 B. D. Chaudhary (M, E)
1204/23 Shivajinagar, Poona 5.

9. AM 9750 Dr. S. H. Chippalkatti (M)
395 Yevalekar Wada, Sambhare Road, Gaonbhag, Sangli.

10. M 1726 R. S. Deshpande (C)
433/6 Saraswat Colony, Poona 2.

11. M 2020 M. M. Doshi (C)
General Manager, Cooper Engineering Ltd., Satara Road.

12. AM 3496 V. S. Godbole (C)
'Nilima', 2072 Sadashivpeth, Poona 2.

13. M 2346 G. T. Gokhale (C)
'Nirbhaya', 1961 Sadashivpeth, Poona 2.

14. AM 2995 M. H. Gunda (M)
Principal, Government Polytechnic, Sholapur.

15. M 2278 Col. S. B. Jambusarwalla (M, E)
Southern Command, Poona 1.

16. AM 4697 Col. R. Janardhanam (M, E)
Institute of Armament Studies, Kirkee, Poona 3.

17. M 1632 D. V. Joglekar (C)
547 Sadashivpeth, Poona 2.

18. AM 2009 M. V. Joglekar (C)
Consulting Engineer & Designer, 1311 Shivjinagar, Poona 5.

19. AM 4030 V. V. Kale (C)
Executive Engineer, Stores Division, Koyna Project, Karad, District Satara.

20. AM 4781 B. S. Kapre (C)
Executive Engineer, Designs Division No. 11, Koyna Project, P.O. Karad, Patna, District Satara.

21. M 1003 R. B. Karandikar (C)
26 Deccan Gymkhana Colony, Poona 1.

22. AM 4546 N. D. Karbhase (C)
936/1 North Sadar Bazar, Sholapur.

23. M 1696 M. G. Karmarkar (C)
1233/D Rao Bahadur Apte Road, Poona 4.

24. M 1155 S. L. Kirloskar (M)
Director & General Manager, Kirloskar Oil Engines Ltd., Krikee, Poona 3.

25. AM 4656 P. T. Kulkarni (E)
'Swapana', 44 Vijayanagar Colony, Poona 2.

26. AM 2491 B. L. Mandke (M, E)
Kirloskar Oil Engines Ltd., Elphinstone Road, Kirkee, Poona 3.

27. M 1473 G. K. Manolikar (C)
33/3 Erandavane, Poona 4.

28. AM 1318 H. K. Master (C)
4 Ardeshar Bagh, Ardeshar Irani Road, Poona 2.

29. M 1614 A. G. Maydeo (C)
767/13 Shivajinagar, Poona 4.

30. AM 6467 V. G. Mehendaley (Ch)
631/26 Sadashivpeth, Poona 2.

31. AM 1781 G. P. Nagarkar (C)
492 Narayanpeth, Poona 2.

32. M 2160 Dr. N. S. Nandeeswaraiya (M)
Professor of Mechanical Engineering, College of Military Engineering, Kirkee, Poona 3.

33. AM 1616 S. K. Nourgaonkar (C)
141 Kasbapeth, Poona 2.

34. AM 3949 K. M. Patil (M)
Head of Mechanical Engineering Department, Government Polytechnic, Sholapur.

35. AM 5041 K. Ramchandra Rao (C)
Superintending Engineer, Irrigation Project, Irrigation Circle, Poona 1.

36. AM 8415 R. T. Ranade (C)
Lecturer in Civil Engineering, Walchand College of Engineering, Sangli.

37. M 2181 Prof. B. N. Sanyal (C)
Professor of Civil Engineering, College of Military Engineering, Kirkee, Poona 3.

38. M 964 B. R. Sardesai (C)
Retired Executive Engineer, 917/27 Ganeshwadi, Poona 4.

39. AM 5131 Prof. M. G. Shah (C)
Professor & Head of Civil Engineering Department, Government Engineering College, Karad.

40. AM 4974 G. H. Sujan (M, E)
Mechanical Engineering Department, College of Engineering, Poona 5.

41. M 1507 Prof. G. V. Vartak (C)
552 Shanwarpeth, Poona 2.

42. AM 2022 D. V. Virkar (M, E)
94 Shukrawarpeth, Poona 2.

43. AM 1036 S. E. Wadia (C)
Magdala Cottage, 15 Bund Garden Road, Poona 1.

44. AM 6430 R. S. Tiwalli (E)
Walchand College of Engineering, Sangli.

Punjab Centre

1. M 1759 R. C. Bhandari (E)
Head of Electrical Engineering Department, Guru Nanak Engineering College, Ludhiana.

2. M 1673 R. N. Chona (E)
Chief Engineer (Construction), Punjab State Electricity Board, 10 Civil Lines, Patiala.

3. AM 8462 A. R. Garg (C)
Thapar Institute of Engineering & Technology, Patiala.

4. AM 1508 R. M. Hemani (C)
Superintending Engineer, Punjab P.W.D., 1st Public Health Circle, Secretariat Buildings, Patiala.

5. M 2326 Dr. M. L. Jain (E)
Professor and Head of Electrical Engineering Department, Thapar Institute of Engineering & Technology, Patiala.

6. M 2062 Jatindra Singh (C)
Director Central Designs, Irrigation Branch, Old Scretariat Buildings, Chandigarh.

7. AM 5858 Maj. A. L. Khanna (C, M)
S0 2 (G), Head Quarters Western Command, Engineers Branch, Simla 3.

8. AM 10104 K. K. Lakhanpal (C)
Executive Engineer, Fatehabad Division, 2nd Bhakra Main Line Circle, Hissar.

9. M 2071 Madan Lal (C)
Director Central Design, Irrigation Works, Chandigarh.

10. AM 3912 I. N. Mehta (C)
Executive Engineer, Project Public Health Division No. 1, Chandigarh.

11. M 1689 V. S. Mittal (E)
Chief Electrical Engineer, Municipal Power House, Amritsar.

12. AM 1949 S. K. Mitra (M)
Engineer-in-Charge Water Works & Drainage, Simla Municipality, Simla.

13. M 2292 P. K. Mukherjee (C)
Joint Director (B & S), R.D.S.O., Ministry of Railways, Ellerslie, Simla 2.

14. M 2406 Nand Kishore (C)
Hargolal & Sons, Hargolal Road, Ambala Cantonment.

15. AM 3032 M. M. Patel (C)
Additional Chief Engineer, Himachal Pradesh P.W.D., Bilaspur

16. AM 2709 Pratap Singh (M, E)
Superintending Engineer, Punjab State Electricity Board, Jullundur Circle, Jullundur.

17. AM 1783 Ram Bilas (C)
Superintending Engineer, Punjab P.W.D. (B & R), 20 Patel Park, Ambala Cantonment.

18 AM 4473 P. S. Sagoo (C)
28/6-J Sector 7, Chandigarh.

19. AM 5017 H. C. Sahgal (E)
Superintending Engineer (Project), Punjab State Electricity Board, Patiala.

20. AM 3694 D. R. Singal (C)
Superintending Engineer, Public Health Circle (North), Jullundur City.

21. M 2163 Prof. Swami Saran (E)
Professor & Head Electrical Engineering Department, Punjab Engineering College, Chandigarh.

Rajasthan Centre

1. M 2357 R. M. Advani (C)
Vice-Principal, M. B. M. Engineering College, Jodhpur.

2. M 2356 S. K. Agrawal (C)
Principal, Bikaner Polytechnic, Bikaner.

3. M 1777 K. N. Bhargava (C)
Additional Chief Engineer, Public Health Engineering, Jaipur.

4. M 1058 Brahma Singh (C)
Gyan Singh Building, Opposite Dungar College, Bikaner.

5. AM 3758 N. H. Desai (M, E)
Chief Engineer, Cement Factory, Kaipur Udyog Ltd., Sawai Madhopur.

6. M 1213 V. G. Garde (C)
Principal, M.B.M. Engineering College, Jodhpur.

7. AM 5051 S. N. Goel (C)
Principal, Jodhpur Polytechnic, Jodhpur.

8. M 2330 K. Gopinath Rao (C)
Superintending Engineer, P.W.D. (B & R), Bikaner.

9. AM 5527 B. K. Jain (C)
Principal, Alwar Polytechnic, Alwar.

10 M 1683 Prof. V. Lakshminarayanan (M)
Principal, Birla College of Engineering, Pilani

11. M 1270 Dr. D. R. Malhotra (Ch, MM)
White House, Golf Course Road, Ajmer.

12. M 2354 R. L. Malhotra (C)
Superintending Engineer (Irrigation) Udaipur Circle, Udaipur.

13. AM 1431 B. D. Mathur (C)
Additional Chief Engineer P.W.D. (B & R), Jaipur.

14. AM 2548 J. L. Mathur (C)
Superintending Engineer, P.W.D. (B & R.), Jodhpur.

15. M 1412 K. L. Mathur (C)
Chief Engineer, Irrigation, Jaipur.

16. M 1609 Moti Ram (C)
Chief Engineer Irrigation, Jaipur.

17. M 1686 S. L. Nayyar (C)
Regional Engineer, Sahu Cement Service, Ravindra Bhavan, Mirza Ismail Road, Jaipur.

18. AM 2331 D. P. Rastogi (C)
Superintending Engineer, P.W.D. (B & R.), Bikaner.

19. AM 4890 G. C. Sastry (C)
Executive Engineer (Designs), Rajasthan Canal Project, Jaipur.

20. AM 2267 K. C. Satsangi (M, E)
Chief Engineer (Electrical & Mechanical), Rajasthan State Electricity Board, Jaipur.

21. AM 2581 K. N. Sharma (C)
Superintending Engineer, P.W.D. (B & R.), Kotah Circle, Kotah.

Uttar Pradesh Centre

1. M 1256 B. K. Agarwal (C)
Retired Superintending Engineer, Jawaharlal Nehru Road, Tagore Town, Allahabad.

2. AM 3364 R. P. Agarwala (C)
Executive Engineer, Chandra Prabha Division, Varanasi.

3. M 2041 G. K. Agrawal (C)
Retired Chief Engineer, 36 Jawaharlal Nehru Road, Tagore Town, Allahabad.

4. M 2158 K. M. Agrawal (C)
Executive Engineer, Designs Division, Irrigation Research Institute, Roorkee.

5. M 1455 L. N. Agrawal (C)
Retired Depty Chief Engineer, Old City Bazar, Etawah.

6. M 1626 L. S. Agrawal (C)
Consulting Engineer & Architect, c/o. Parmeshwari Dass Block, Barunikhandaq, Lucknow.

7. AM 4367 R. M. Agrawala (C)
Superintending Engineer, IX Circle, Public Works Department, Lucknow.

8. M 1515 Z. Ansari (C)
Principal, College of Engineering, Aligarh University, Aligarh.

9. M 1342 M. Athar (C)
Professor, College of Engineering, Aligarh University, Aligarh.

10. M 1618 A. P. Bagchi (C)
Regional Engineer, Sahu Cement Service, Mahmoodabad Building, Hazratganj, Lucknow.

11. M 1349 C. C. Bagchi (C)
Chartered Engineer, C-1053/1054 Mahanagar, Lucknow.

12. M 1833 N. J. Balani (M, E)
Works Manager, Hindustan Aluminium Corporation Ltd., P.O. Renukoot, Mirzapur.

13. M 1980 Lt.-Col. D. N. K. Banerjee (M)
68 Rajpur Road, Dehra Dun.

14. AM 2615 P. K. Banerji (C)
Superintending Engineer, Public Works Department, D1/2 River Bank Colony, Lucknow.

15. M 2419 B. B. Basu (C)
Superintending Engineer (Planning), Chief Engineer's Office, Eastern Command, Lucknow.

16. M 1646 O. P. Bhasin (C, M, E)
Chief Engineer, Electricity Department (Hydel), Vikramaditya Marg, Lucknow.

17. M 2256 P. S. Bhatnagar (C)
Additional Chief Engineer, Public Works Department, Lucknow.

18. M 2314 B. M. Bhatt (M, E)
Chief Engineer, Swadeshi Cotton Mills Co., Ltd , Block No. A-1, Kanpur.

19. M 504 M. C. Bijawat (C)
Pro-Vice-Chancellor, Banaras Hindu University, Varanasi.

20. M 2189 G. D. Bishnoi (M, E)
Chief Inspector of Factories, Kanpur

21. M 1320 A. N. Bose (C)
Superintendent, Shahadra-Delhi-Saharanpur Light Railway Co., Ltd. Saharanpur.

22. M 1785 V. Cadambe (M)
338-B Mahanagar, Lucknow.

23. M 1360 C. C. Chakravarti (M)
Professor of Mechanical Engineering, Engineering College, Banaras Hindu University, Varanasi.

24. M 2512 K. K. Chakravarti (C)
Chief Engineer, Nagar Mahapalika, Kanpur.

25. AM 3849 A. Chandra (C)
Superintending Engineer III Circle, L.S.G.E.D., Lucknow.

26. AM 4536 S. K. Charan (C)
Superintending Engineer, VI Circle, P.W.D., Gorakhpur.

27. M 2493 Prof. R. S. Chaturvedi (C)
Professor & Head of Civil Engineering Department, University of Roorkee, Roorkee.

28. M 1525 U. L. Chaturvedi (C)
Professor of Civil Engineering, University of Roorkee, Roorkee.

29. M 2232 S. R. Chowdhury (C)
Superintending Engineer, Irrigation Works Circle, Faizabad.

30. M 687 Chhuttan Lal (C)
'Saket', 1 Old Survey Road, Dehra Dun.

31. M 1358 P. B. Das (C)
107 Tagore Town, Allahabad.

32. M 2495 Dinesh Mohan (C)
Deputy Director, Central Building Research Institute, Roorkee.

33. M 2407 R. Dutta (C)
Superintending Engineer (Additional), Central Designs Directorate, Lucknow.

34. M 1479 S. S. Gairola (C, M)
Head of the Department of Civil & Municipal Engineering, Banaras Hindu University, Varanasi.

35. M 2179 Lt.-Col. D. K. Ghose (C)
Chief Engineer's Office, Eastern Command, Lucknow.

36. M 1893 Lt.-Col. A. C. Gossain, (M, E)
C/o Mayadass Shivram Dass Gossain, Brassware Merchant, Bhatti Street, Moradabad.

37. M 1676 B. D. Goyal, (C)
Director of Refresher Courses, University of Roorkee, Roorkee.

38. AM 8301 K. C. Goyal, (C)
Superintending Engineer, Sarju Canal Circle, Irrigation Colony, Gonda.

39. AM 2263 B. K. Gupta, (C, M, E)
Superintending Engineer, III Circle, Irrigation Works, Agra.

40. M 1457 H. R. Gupta (C)
Retired Chief Engineer, P.W D., 93F Swaminagar, Dayal Bagh, Agra.

41. M 780 K. C. Gupta (E)
General Manager, Kanpur Electric Supply administration, Kesa House, 14/71 Civil Lines, Kanpur.

42 M 793 M. C. Gupta, (C)
Consulting Engineer, 38A Thornhill Road, Allahabad.

43. M 2263 O. P. Gupta (C)
Superintending Engineer, I Circle, Irrigation Works, Meerut

44. M 1201 P. L. Gupta (C)
Retired Chief Engineer, 1/1 Kabir Marg, Lucknow

45. AM 2918 S. N. Gupta (C)
Superintending Engineer, 6 Canal Colony, Lucknow.

46. M 2233 Jagdish Narayan (C)
Chief Engineer (West), Irrigation Department, Cantonement Road, Lucknow.

47 M 1589 Jagdish Prasad (C)
Chief Engineer, Public Works Department, Lucknow

48 M 2092 Dr. Jai Krishna (C)
Associate Professor, Civil Engineering Department, University of Roorkee, Roorkee.

49. M 1566 J. P. Jain, (C)
Chief Engineer (Additional), Irrigation Department, Canal Colony, Lucknow.

50 M 1356 R. S. Jain (C)
'Sukh Niwas', Railway Road, Meerut City

51. M 1916 S. K. Jain, (C)
Superintending Engineer, Tons Circle, Construction Circle, Yamuna Colony Idgah Chakrata Road, Post Box No. 84, Dehra Dun.

52. M 1044 D. N. Jayakar, (C)
Principal, Government Technical Institute, Lucknow

53. M 2513 Kali Charan (C)
Deputy Chief Engineer (Bridges), North-Eastern Railway, Gorakhpur.

54. AM 4534 Kartik Prasad (C)
Superintending Engineer, P.W.D., Darshan Vilas, Chhota Chhatar Manzil, Lucknow.

55. M 1596 H. L. Kashyap (E)
Electric Inspector to Government, Vikramaditya Marg, Lucknow.

56. M 1157 K. N. Kathpalia (C)
Pro-Vice-Chancellor, University of Roorkee, Roorkee.

57. M 2159 H. C. Kaushal (C)
Deputy Development Commissioner (Technical), Irrigation Department, 102 Kabir Marg, Lucknow.

58. M 1112 A. H. Khan (C, M)
Retired Chief Inspector of Boilers, 11/29 Civil Lines, Kanpur.

59. AM 6159 S. B. Khare (C)
Personal Assistant, Chief Engineer's Office, Irrigation Department, Lucknow.

60. M 1962 Maj. R. K. Kochhar (C)
Superintending Engineer, P.W.D., XII Circle, Pithoragrah.

61. M 2204 Krishna Murari (C)
Superintending Engineer, Ramganga Construction Circle, Moradabad.

62. M 870 K. B. Lal (C)
Retired Government Inspector of Railways, 3 Clay Square, Lucknow.

63. AM 9610 Mahabir Prasad (C)
Superintending Engineer (Planning), Public Works Department, Lucknow.

64. M 1804 B. S. Mahal (M, E)
Superintending Engineer, S.O. I E/M Engineers Branch, Chief Engineer's Office Eastern Command, Lucknow.

65. M 2034 D. D. Majumdar (M, E)
Director, Small Industries Service Institute, Ministry of Commerce & Industry, 113/80 Swarupnagar, Kanpur.

66. M 1877 A. N. Malhotra (C)
Professor Planning Water Resources Development Training Centre, University of Roorkee, Roorkee.

67. M 2418 N. J. Masani (C)
10 New Forest, Dehra Dun.

68. M 2066 A. C. Mathur, (C)
Additional Secretary to Government, Relief & Rehabilitation Department, U.P. Civil Secretariat, Lucknow.

69. M 1491 B. S. Mathur (C)
Director, Water Development Research Training Centre, University of Roorkee, Roorkee.

70. M 2448 K. C. Mathur (C)
Superintending Engineer, III Circle, P.W.D., Bareilly.

71. AM 2423 S. B. Mathur (C)
Superintending Engineer, III Circle, P.W.D., Chamoli.

72. M 1195 K. C. Mazumdar, (C)
20/3A Jawaharlal Nehru Road, Allahabad.

73. M 2100 M. A. Mirza, (C)
Deputy Chief Engineer, Public Works Department, Lucknow

74. M 1952 K. N. Misra, (C)
Chief Engineer, Town & Village Planning Department, 15 A. P. Sen Road, Lucknow.

75. M 2211 P. R. Mital (M, E)
Superintending Engineer, Tube-well Circle, Irrigation Works, Meerut

76. M 1253 A. C. Mitra, (C)
Chief Engineer, Irrigation Department, 1 Canal Colony, Lucknow.

77. M 1110 J. N. Mitra (C)
7A Rt. Bahadurji Road, Parsi Club, Mirabai Marg, Lucknow.

78. M 1152 L. C. Mittal, (C)
23/1 Roorkee Road, Muzaffarnagar.

79. M 783 A. C. Mukerjee, (M)
Retired Chief Engineer, P. W. D., 121 Faizabad Road, Lucknow.

80. M 1984 Musaddi Lal (C)
Retired Chief Engineer, L.S.G.E.D., & Nagar Abhiyanta, Drainage, Mahapalika, Lucknow.

81. M 1476 G. Pande (C)
Vice-Chancellor, University of Roorkee, Roorkee.

82. M 2242 J. C. Pande (M, E)
Chief Engineer, Government Cement Factory, P.O. Churk, Mirzapur.

83. M 1962 V. P. Pandey (C)
Reader in Civil Engineering, Engineering College, Banaras Hindu University, Varanasi.

84. AM 8070 L. D. Pathak (E)
Superintending Engineer, Rihand Hydel Generation Circle, Pipri, Rihand Dam Site, Mirzapur.

85. M 1979 R. S. Pathak (M, E)
Chief Engineer, The New Victoria Mills Ltd., Kanpur.

86. AM 4318 Prem Manohar (C)
Superintending Engineer, II Circle, P.W.D., Agra

87. M 2076 Radhey Shiam (C)
Superintending Engineer, Irrigation Works Circle, Bareilly.

88. M 335 M. Rao (C)
Chartered Engineer, 1699 Ghatia Azam Khan, Agra.

89. M 786 G. S. Ram (C)
Joplinganj, Ballia.

90. M 2486 G. S. Ramaswamy (C)
Deputy Director, Central Building Research Institute, Roorkee.

91. M 850 Ramesh Chandra (C)
Retired Chief Engineer, 19 Elgin Road, Allahabad.

92. M 2440 D. H. Ramchandra Rao (C)
40A Beli Road, New Katra, Allahabad.

93. M 1931 K. K. Rao (C)
Director Research, Railway Testing & Research Centre, Ministry of Railways, Alambagh, Lucknow.

94. M 1210 D. P. Rohatgi (C)
Retired Chief Engineer, 144 Canal Road, Near Johari Devi Girls College, Kanpur.

95 M 2482 A. K. Roy (C)
Chief Engineer, L. S. G. E. D., 6 Rana Pratap Marg, Lucknow.

96. AM 2818 P. N. Roy (C)
Superintending Engineer, XIV Circle, P.W.D., Rampur

97. M 2166 N. C. Saha (E)
Professor & Head of Department, Department of Electrical Engineering, Aligarh Muslim University, Aligarh.

98. M 2213 S. P. Sahni (C)
Superintending Engineer, Irrigation Works, IV Circle, Jhansi.

99. M 1914 A. Sanghi (M, E)
.Superintending Engineer, Tubewell Circle, Aligarh.

100. M 1144 D. N. Sanyal (C)
c/o. R. N. Sanyal & Sons Ltd., 8 Shivaji Marg, Lucknow.

101. M 1846 R. Saran (C)
Retired Superintending Engineer, 746-B Sector C, Mahanagar, Lucknow.

102. M 812 M. G. Sardana (C)
13 Dubhalwala Road, Dehra Dun.

103. M 1739 R. K. Sarma (M, E)
Chief Electrical Engineer, Sahu Chemicals, Varanasi.

104. M 2241 R. Sarup (E)
Resident Engineer, Municipal Board, Meerut.

105. M 2331 B. D. Satsangi (E)
Principal, Engineering College, 151 Soaminagar, Dayal Bagh, Agra.

106. AM 4239 V. D. Seth (E)
Superintending Engineer (Hydel), Ganga Circle, Aligarh.

107. M 2494 P. B. Shahani (C)
Reader in Civil Engineering, University of Roorkee, Roorkee.

108. M 2342 B. P. Sharma (C)
Executive Engineer, Etawah Division, Lower Ganga Canals, Etawah.

109. AM 6136 O. D. Sharma (C)
Superintending Engineer, Obra Dam Construction Circle, Pipri, P.O. Turra, Mirzapur.

110. M 2613 R. K. Sharma (E)
Principal, Govt. Polytechnic, Bakshi-ka Taluk, Lucknow.

111. M 1369 S. S. Sharma (C)
Retired Superintending Engineer, Haripadam, New Colony, Bhadaini, Varanasi.

112. M 2315 Shobha Ram (C)
7/71 Tilaknagar, Kanpur.

113. M 956 Balbir Singh (C)
Retired Chief Engineer, Irrigation Department, 'Ananda' Clive Marg, Allahabad.

114. M 1138 B. M. Singh (M)
Professor and Head of Department of Mechanical Engineering, Engineering College, Banaras Hindu University, Varanasi.

115. M 2010 G. B. Singh (C)
Deputy Chief Engineer, 12 Railway Colony, P.O. Chopan, Mirzapur.

116. M 2210 G. Singh (E)
Retired Superintending Engineer (Hydel), 4 Tilak Road, Cantonement, Lucknow.

117. M 2425 Air Vice-Marshal H. Singh (M)
Air Officer Commanding in Chief, Maintenance Command,Indian Air Force, Kanpur.

118. M 1367 J. Singh (C)
E. Kant, P.O. Clement Town, Dehra Dun.

119. M 1036 M. Singh (C)
Farm House, P.O. Clement Town, Dehra Dun.

120. AM 3794 Brig. S. D. Singh (C)
Chief Engineer, Eastern Command, Lucknow.

121. M 2316 S. N. Singh (E)
Chief Engineer, Mathura Electric Supply Co., Ltd., Mathura.

122. M 1691 S. R. Singh (C)
Dean, University of Roorkee, Roorkee.

123. M 2219 Sqdn.-Ldr. T. Singh (M)
Air Force Station, Agra Cantonement.

124 M 1079 U. Singh (C)
Sampat Bhawan, Happy Valley, Mussoorie, Dehra Dun

125 M 2385 K. Sinha (C)
Nagar Abhiyanta, Nagar Mahapalika, Mahapalika Bhawan, Sigra, Varanasi.

126. M 1702 Flt.-Lt. S. M. S. S. Sinha (M)
Deputy Director of Training and Employment, Old Post Office Building, Hazratganj, Lucknow.

127. M 1379 S. P. Sinha (E)
Resident Engineer, U.P. Electric Supply Co., Ltd., Lucknow.

128. M 1957 K. C. Sood (C)
Chief Engineer Construction, Northern Railway, P.O. Chopan, Mirzapur.

129. M 1798 R. C. Sood (C)
Aranya Kutir, Jakhan, Dehra Dun

130. M 2382 C. P. Srivastava (M, E)
20 Darbhanga Castle, Motilal Nehru Road, Allahabad.

131. M 1983 J. P. Srivastava (C)
Superintending Engineer, I Circle, L.S.G.E.D., Varanasi.

132. M 1760 P. N. Srivastava (C)
Superintending Engineer, V Circle, P.W.D., Allahabad.

133. M 1362 L. Swarup (C)
Retired Superintending Engineer, P. W. D, Tirgaran, Meerut.

134. M 1782 B. S. Talwani (C)
Professor, Construction, Water Resources Development Training Centre, University of Roorkee, Roorkee

135 M 939 B. B. Varma (C)
14 Jawaharlal Nehru Road, Tagore Town, Allahabad.

136. M 1458 R. D. Varma (C, M. E)
Member (Production), Oil & Natural Gas Commission, Patiala House, Dhera Dun.

137. M 1766 H. G. Verma (C)
Project Engineer, Antibiotics Project, Rishikesh, Dehra Dun.

138. M 1280 Dr. J. W. Whitaker (MM)
Director, Indian Institute of Petroleum, 19A Lytton Road, P.B.80, Dhera Dun.

139. M 1214 Lt.-Gen. H. Williams (C)
Director, Central Building Research Institute, Roorkee.

INSTITUTION NEWS

Reception to Dr. A. N. Khosla, M.I.E., on his appointment as Government of Orissa

On August 21, 1962, a reception was accorded at Ashoka Hotel, New Delhi, to Dr. A. N. Khosla, M.I.E., Member, Planning Commission, and a Past-President of the Institution, on his appointment as Governor of Orissa.

The reception, besides our members, was well attended by several dignitaries including Dr. Zakir Husain, Vice-President of India, Shri V. K. Krishna Menon, Defence Minister, Sardar S. Swaran Singh, Minister for Railways, Prof. Humayun Kabir, Minister for Scientific Research and Cultural Affairs, Shri Hafiz Mohammad Ibrahim, Minister for Irrigation and Power, Mr. John Kenneth Galbraith, U.S. Ambassador and Mrs. Galbraith and others.

Maj.-Gen. Harkirat Singh, M.I.E., President of the Institution, during the course of his speech remarked that Dr. Khosla's appointment to this high office was not only a recognition of his selfless service to the nation for many long years, but was also a matter of pride for the engineering profession as a whole. He on his own behalf and others present congratulated Dr. Khosla on his new assignment.

Shri Hafiz Mohammad Ibrahim, who then spoke said that he knew Dr. Khosla for the past several years and saw in him the quality of an intellectual giant coupled with a strong will power. He assured the audience that Dr. Khosla will be the right man to pilot the State of Orissa towards prosperity, pleasure and plenty both in economic and industrial fields in this crucial period.

Dr. Khosla, while thanking the members for the affection shown to him, remarked that the main object of his accepting the Governorship of Orissa was that he saw in that State tremendous opportunity and scope where engineering knowledge and skill coupled with the cooperation of the people could profitably be channalized towards the betterment of the people of the State.

FORTHCOMING CONFERENCES

Corrosion and Metal Finishing Exhibition 1962, Olympia, November 27-30, 1962

An exhibition on 'Corrosion and Metal Finishing' is being organized at Olympia, from November 27-30, 1962. Technical meetings will also be arranged on the following topics :

(i) Metal finishing

(ii) Corrosion resistant plastics

(iii) Cathodic protection

Further details can be had from the Corrosion and Metal Finishing Exhibition 1962, The Tower Brook Green Road, Hammersmith, London, W6.

Convention on H.F. Communication, London, March 25-27, 1963

The Electronics Division of the Institution of Electrical Engineers is arranging a Convention on H.F. Communication to take place in March 1963. The scope of the convention has been divided to include

(i) Propagation (including a survey of the transmission medium and its effect on performance)

(ii) Aerials (including feeders and distribution equipment)

(iii) Systems (including telegraph, voice, facsimile and data transmission, error detection and correction, modulation methods and systems engineering)

(iv) Fixed equipment

(v) Applications and operational problems (including frequency management and, present and future uses in fixed and mobile services).

Further details can be obtained from the Secretary, The Institution of Electrical Engineers, Savoy Place, London, W.C. 2.

International Conference and Exhibit on Aerospace Support, Washington, August 4-9, 1963

The nature of the aerospace support problem is characterized by its broad scope. A wide variety of support functions are administered on behalf of the aerospace mission from the moment that manufacture is started until the vehicle is delivered to its launching or take-off site, arrives at its destination, or persists in its task if this task is a long-range orbital journey. The handling phase must provide not only erection facilities and launching aids for huge vehicles, but observe special precautions against shock and vibration damage on vehicles of all sizes. This often requires special instrumentation to monitor shipping and handling operations in order to detect whether or not tolerable shock and vibration levels have been exceeded. Instrumentation, telemetry, locating and tracking, and communications are all distinct phases of the support effect. An exhaustive attempt is made to keep track of all vehicular functions. Biological instrumentation is critical for manned flight. Telemetry and communication maintain the information links from the vehicle or payload to observer, or in support of the earthbound logistics operation. Locating and tracking by radio, radar, and optical techniques are critical support functions, extending even to the aspect of safety of personnel at and around the launching site, or under the line of flight. The task of coordinating the observational and data collection aspects is a considerable problem in logistics which requires logical planning and execution. The electrical and mechanical engineers have teamed up with the logistics expert, and the medical and biological man to contribute jointly and directly to support effort.

Further details of this conference can be had from the International Conference and Exhibit, Box 6635, Washington, D.C., U.S.A.

International Measurement Conference (IMEKO), Stockholm, April 1964

The International Measurement Conference (IMEKO) will be held in Stockholm in April 1964. The main theme of the conference is to discuss the latest scientific achievements within fundamental and applied research in important branches of measurement and instrumentation. Papers dealing with the theory or practice of measurement and instrumentation, of interest to the research scientist as well as to specialists engaged in the design and manufacture of instruments, will be presented at the conferenee.

The sections of the conference will be classified to deal with papers concerning

(i) Fundamental problems of technology

(ii) Theory and practice of instrument design

(iii) Technology and organization in instrument manufacture

(iv) General electronics as applied to measurements and instruments

(v) Border questions of measurement and automation

(vi) Instruments and methods for measuring geometrical and mechanical quantities, including geodetic measurements

(vii) Instruments and methods for measuring thermal quantities

(viii) Instruments and methods for physico-chemical measurements

(ix) Instruments and methods for measuring electrical and magnetic quantities

(x) Instruments and methods for measurements in radio engineering, and

(xi) Instruments and methods for measuring radioactive radiation.

Papers submitted for presentation should contain unpublished original results in the field of fundamental or applied research. Papers which have been published previously in a technical journal of a limited circulation are also permitted, and in that case, a copy of this publication should also be attached to the abstract.

Further details can be had from the IMEKO Secretariat, Budapest 5, P.O. B. 3, Hungary.

BOOK ACKNOWLEDGMENTS

1. **Water Supply Engineering.** S. R. Kashirsagar. *Roorkee Publishing House, Roorkee*, Rs. 10.50. 356 pages.

This book explains the basic theories and practices followed in the field of sanitary engineering in India today. A study of the requirements for rural areas is included. Though primarily written for under-graduate students of civil engineering, it is expected that practising sanitary engineers will also find it useful.

2. **Heat Engine Laboratory.** Dr. S. K. Sachdev. *Atma Ram & Sons, Delhi*, Rs. 9.50. 184 pages.

This text-book on practical thermodynamics for engineering students and practising engineers is designed to familiarize the student with the instruments and equipment used in a heat engine laboratory. A good portion of the book is devoted to observational methodology and analysis of results.

3. **Electrical Machinery.** C. V. Govinda Rao. *Nem Chand & Bros., Roorkee*, Rs. 15. 525 pages.

The aim of this text-book is to present the basic principles governing the operation of the electromagnetic devices without going into rigorous mathematical treatment. The book is written to meet the requirements of students endeavouring to make their first entry into the field of electrical engineering.

4. **General Electrical Engineering.** T. R. Ganesan. *NCBH (Private) Ltd., Madras*, Rs. 6.00. 272 pages.

This elementary text-book on electricity and electrical engineering written for the student is designed to cover the fundamentals of electrical engineering. A brief introduction to the M.K.S. units is given.

5. **Reinforced Concrete.*** E. Sigalov and S. Strongin. *Foreign Languages Publishing House, Moscow*, Rs. 6.37. 393 pages.

This text-book, intended not only as a course in reinforced concrete but as a practical designers' handbook, presents the modern methods of design for both ordinary and prestressed reinforced concrete structures. Studies of resistance of reinforced concrete and determination of cross-sections are illustrated by practical examples. The basic economic aspects in the design of reinforced concrete construction and its adaptability to industrialized methods are also presented. Attention is given to the design of floors in multistorey buildings and single-storey industrial buildings. The design of joints in precast concrete members is also dealt with in detail.

6. **Machine Elements.*** V. Dobrovolsky, K. Zablonsky, S. Mak, A. Radchik, and L. Erlikh. *Foreign Languages Publishing House, Moscow*, Rs. 8.88. 579 pages.

This text-book, illustrated with diagrams, treats the problems of design of machine elements for strength and describes the latest designs of machine elements and various types of joints and drives used in mechanical engineering today.

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* These books are available from NCBH (Private) Ltd., 6, Nallathambi Chetty Street, Madras 2.

7. **Technical Thermodynamics.*** V. V. Sushkov. *Foreign Languages Publishing House, Moscow,* Rs. 6.06. 395 pages.

This is an introduction to the basic laws of thermodynamics and their application to the design of heat engines, including reciprocating steam engines and turbines, internal combustion engines, gas turbines, jet engines and refrigerating machinery. The theory of streaming is given in detail. Among other topics dealt with is that of compression, in particular, the air compressor.

8. **Heat Treatment of Metals.*** B. Zakharov. *Foreign Languages Publishing House, Moscow,* Rs. 5.37. 295 pages.

This informative volume is divided into four parts. Part one deals with transformations in steel during its heat treatment, part two delineates in detail the elements of the process of heat-treating, part three describes the heat treating processes, and part four discusses the heat treatment of cast irons and nonferrous alloys.

9. **Basic Electrical Engineering.*** A. Kasatkin and M. Perekalin. *Foreign Languages Publishing House, Moscow,* Rs. 8.87. 388 pages.

This book is a comprehensive treatise on the basic principles of electrical engineering. Apart from the topics usually dealt with in similar volumes, some chapters are devoted to the discussion of the basic principles of electronic and ionic devices. The treatment, though elementary and unsophisticated, is very thorough. A few Russian inventors and engineers have been mentioned under the various topics, whose names may not be so familiar to readers outside the U.S.S.R.

10. **Permanent Magnets and Magnetism.** Edited by D. Hadfield. *Iliffe Books Ltd., London,* 105s. 556 pages.

This volume, written as a symposium volume by a panel of specialists under a general editorship, attempts to collate all available information on permanent magnetism in all its diverse and specialized nature. A vast amount of literature in the form of published papers, and also a considerable amount of hitherto unpublished work on the subject, particularly of an industrial or applied nature, is presented in a comprehensive manner. Designed to be potentially useful to electrical and mechanical engineers, and to those concerned with the technical and practical aspects of magnet design and manufacture and post-graduate students of physics, electrical engineering and metallurgy, each chapter in the volume is complete and comprehensive, there being occasional overlapping of material which apparently is unavoidable. A principal feature of this presentation is the use of the M.K.S. system of units which has almost received universal acceptance. Equivalent C.G.S. units, values and equations are also given alongside.

PUBLICATIONS RECEIVED

The following publications have been recently received from the Metallurgical Services, Betchworth, Surrey, England: (1) 'Introductory Practical Metallography' by A. R. Bailey. Designed for engineers and others intending to follow introductory courses in metallurgy and thus requiring a concise introduction to the microstructure of metals, the aim of this monographs is to supply a simple and comprehensive course in metallography. The structures are classified into a number of logical groups, depending on the manner of formation. Typical specimens are provided for each groups. Only 37 specimens have been dealt with, and the use of a large number of examples has been avoided to prevent the clear emergence of the overall pattern of behaviour. Though sufficient background information has been given to make the course self-sufficient, the amount of theoretical information has been purposely limited. (2) 'The Aluminium-Copper-Silicon System' by D. L. Thomas. The microstructure of metals is extremely important to an understanding of their physical behaviour. This second number of a special series of monographs on metallographic specimens provides an introduction to the crystallization of ternary alloys. It gives a full account of the solidification of alloys rich in aluminium pertaining to the Al-Cu-Si system, based on 14 microspecimens and corresponding ingots for thermal analysis. The book is illustrated with 19 photomicrographs and typical cooling curves of the alloys. Prior assimilation of the general principles of structure from the first title of the series (*viz.*, from the 'Introducductory Practical Metallography' by A. R. Bailey) is assumed.

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* These books are available from NCBH (Private) Ltd., 6, Nallathambi Chetty Street, Madras 2.

The following publications have been received from Sahu Cement Service, New Delhi: (1) 'Design of Prestressed Concrete Structures' by Dr. K. W. Bieger. Prepared for post-graduate course, the book gives formulae and methods for practical calculations so that the design engineer is able to make statical calculations for prestressed concrete structures. A comprehensive review of the δ_{ik} method which is not commonly taught in Indian colleges is given in the appendix; (2) 'Design of Houses—Upper Income Group'. This pamphlet contains twelve designs of upper income group houses.

The Eighth Anniversary Number of the *Bhagirath* the irrigation and power monthly of the Central Water and Power Commission, Government of India, has been received. It features illustrated articles of national and international interest by eminent men in the field.

A copy of the quarterly journal 'Construction Engineers of India' has been received from the State Engineers' Association, West Bengal. Published under the auspices of the State Engineers' Association, West Bengal, this journal will be of interest to construction engineers. The annual subscription is Rs. 8.00, and the cost of single copy Rs. 2.00.

NAMES OF SUCCESSFUL CANDIDATES IN THE STUDENTSHIP AND ASSOCIATE MEMBERSHIP EXAMINATIONS HELD IN MAY 1962

The following candidates have been declared to have passed the Studenship and Associate Membership Examinations held in May 1962.

STUDENTSHIP EXAMINATION

Roll No.		Name of candidate	Roll No.		Name of candidate
St.	7	J. D. Khatri	St.	39	B. R. Nagaprasanna
St.	30	S. Vittal Rao	St.	44	Meneth K. Abdulla Kunhi

STUDENTSHIP EXAMINATION—*contd.*

Roll	No.	Name of candidate
St.	67	V. Prabhakar
St.	72	M. K. Prabhu
St.	102	Narayan M. Khadse
St.	110	B. S. Tandel
St.	131	S. S. Amrite
St.	133	A. D. Mark Anthony Daniel
St.	134	K. A. Krishna Moorthy
St.	145	Manjaya G. Shetty
St.	160	B. N. Attara
St.	172	S. R. Shetti
St.	174	Stephen M. Pereira
St.	194	Vishnu Datt Dhyani
St.	201	S. Parameswaran
St.	205	Harjas M. Ahuja
St.	206	P. C. Soni
St.	215	S. M. Palkar
St.	221	Pahlaj G. Wadhwa
St.	235	Monoranjan Bhadra
St.	271	Kailash Chand
St.	278	Santokh Singh Gill
St.	286	Gobind Ram
St.	296	Ratan Lal Chablani
St.	299	Raghbir Chand Dheer
St.	313	N. Krishnamurthy
St.	316	Ram Sarup Bhatia
St.	327	Prakash Chander
St.	336	Triloki Nath Bhatnagar
St.	340	Satya Pal Khurana
St.	341	Sham Singh Blah
St.	353	Gurnam Singh Mehta
St.	357	J. S. Kushwah
St.	361	Piyare Lal Handa
St.	372	B. P. Bansal
St.	385	N. R. Syamanarayanan
St.	387	A. Satyendra Prasad
St.	390	E. Venkateswarlu
St.	394	Raj Kumar Singh Bhandari
St.	398	K. S. Dikshitulu
St.	410	M. B. Joshi
St.	413	K. Seeta Ramaiah
St.	444	C. Harinath
St.	450	Indrajit Singh
St.	458	Raj Pal Kakkar
St.	511	Vinaya Shanker Shukla
St.	522	Swami Dayal Tewari
St.	524	Ram Narain Sharma
St.	541	K. C. John
St.	556	B. Surya Prakasa Rao
St.	557	William Joseph
St.	559	P. Venugopala Reddy
St.	571	Gurjit Singh Aulakh
St.	576	P. S. Rangachari
St.	578	G. N. Jyoti Shankar
St.	583	S. Sam Joseph
St.	584	T. G. Nithyanandam
St.	585	P. Nancharaiah
St.	587	N. Sambasivam
St.	589	Bhalaji Rao Ghodke
St.	607	B. Subbarami Reddy
St.	634	Y. Subba Rao
St.	639	V. Subrahmanya Bhat
St.	641	R. Radha Krishna
St.	658	V. Brahman
St.	684	M. Gopalakrishnan
St.	695	P. J. Joseph
St.	705	K. Gopalakrishnan
St.	720	K. Rajaveerappan
St.	725	M. S. Viswanathan
St.	729	E. Smith
St.	733	A. Harrish Menon
St.	765	K. C. Geevarughese
St.	771	M. T. Thomas
St.	775	N. Sundaram
St.	777	P. Govindasamy
St.	778	M. Yeshwant Rao
St.	780	B. Gangaiah
St.	785	K. Ashoke Kumar
St.	786	V. Ramadorai
St.	788	R. Narayanan
St.	792	M. Chandramohan
St.	811	P. C. Sukumar
St.	841	S. Santhanam
St.	849	D. Satyanarayana Raju
St.	852	P. V. B. Satya Dhanapathi
St.	860	K. Subba Raju
St.	861	T. K. Raman
St.	862	P. V. Krishnamurthy
St.	880	V. Sundararaman
St.	882	K. Nara Simha
St.	892	V. Raghavan

STUDENTSHIP EXAMINATION—*contd.*

Roll No.	Name of candidate
St. 895	Ch. Bala R. Murthy
St. 912	Harhit Singh
St. 922	Jagannath T. Gopal
St. 949	K. P. C. Sankaran
St. 998	M. A. Antony
St. 1004	G. M. Pandit

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A

Roll No.	Name of candidate
48A	H. R. Shah
65A	K. Balasubramanian
96A	P. F. Doshi
132A	M. R. Krishnaswamy
143A	H. V. Prahlada Char
144A	G. B. Muralidhar
156A	Prabhakar Rama Hedge
163A	K. J. Raghunath
168A	Mohinder Singh
172A	Vasant Madhwarao Naik
188A	Glynn Philip Bolar
241A	Modaga Narasimhulu
247A	Dev Inder Ohri
256A	T. G. Pandurangavittal
259A	Surednra P. Mohindra
266A	Ramaswami Bhaskara
269A	Mysore B. Vijayendra Rao
285A	Mohinder Singh Chadha
286A	Kunigal G. Shantha Kumar
289A	S. Thangavelu
296A	Changavara S. Shama Rao
319A	N. G. Raja
321A	B. R. Govinda Rao
330A	A. Aswathachari
361A	Hosalli Seshadri
383A	T. S. Subbaraya
387A	Jaldu S. Atchuta Ramayya
392A	Vasantha Kumar
470A	Mrs. L. C. Manoharan
536A	K. T. Sreenivasan
539A	B. Venkatachalapathi Setty
557A	P. Purandar Rao
572A	R. Muniswamy Raju
606A	M. A. Srinivasan
618A	A. R. Rama Rao
640A	D. N. Parameswara Gupta
642A	Sri Sai Das
643A	V. M. S. Nambudiripad
661A	D. R. Srikantaiah
704A	Harish Chandra Agarwal
719A	D. D. Yajnik
766A	Hari Narain Seth
767A	Bimalendu Das Gupta
821A	K. P. Chopra
830A	Pran Krishan Aggarwal
858A	Padmanabhan V. Nair
883A	Prabhakar R. Bhandarkar
901A	T. O. Varughese
910A	Suresh B. Naik
913A	Yashawant Narayan Patade
922A	Kishin W. Tharani
926A	M. Ramakrishna Prabhu
954A	R. R. Kandaday
956A	Arun Kumar Bose
963A	Ramanatha Venkatraman
981A	Sudheer S. Mirajkar
996A	Parasuram Rajaram
1025A	Balaji Shankar Joshi
1032A	G. I. Bhatia
1049A	Krishan Lal Garg
1050A	Vijay Kumar Bassi
1107A	H. M. Saldanha
1130A	S. N. Marwah
1136A	A. G. Ghate
1144A	J. S. Sathe
1188A	S. S. Mulwani
1278A	J. K. Baldua
1301A	D. S. Gadre
1307A	P. P. Samarth
1310A	V. M. Khot
1322A	Ashok Hari Damle
1324A	K. C. Gupta
1326A	S. Raju
1336A	Raghunath D. Wayakole
1359A	L. H. Peshori
1373A	N. Gopalakrishnan
1378A	S. B. Kulshreshtha
1393A	Krishan P. Lachhwani

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A—*contd.*

Roll No.	Name of candidate
1407A	R. R. Sastry
1413A	Parasanta Kumar Lakshman
1434A	Tarit Kumar Banerjee
1455A	Narayan Prasad Dave
1473A	Sukumar Sarkar
1487A	Tapan Kumar Banerjee
1503A	Abu Torab Mallick
1506A	Manoranjan Maji
1542A	Kalyan Kumar Roy
1548A	Rabindra Nath Bandyopadhyay
1559A	G. R. K. Tagore
1561A	Satyesh Chandra Banerjee
1582A	Alok Datta
1626A	Madhusudan Mukhopadhyay
1631A	Ranjit Kumar Chakraborty
1634A	Sukes Ranjan Mukherjee
1647A	Dipak Kumar Majumdar
1661A	Gopal Chandra Bhattacharya
1665A	Pranab Sankar Mitra
1668A	D. K. Mukherjee
1681A	Ramaswamy Santhanam
1698A	Sukumar Mondal
1721A	Asishkamal Nag
1734A	Anil Kumar Hazra
1761A	Saroj Kumar Chattopadhyay
1866A	Sambhunath Banerjee
1869A	Ajit Kumar Bhattacharya
1871A	Amal Kumar Haldar
1872A	Sunil Kumar Rudra
1900A	Asit Kumar Bhattacharyya
1902A	Asit Kumar Roy
1913A	Pulak Purna Sengupta
1916A	Uma Pada Sarkar
1937A	Dilip Kumar Mukherjee
1965A	Manjul Kumar Banerjee
1967A	Chandidas Malik
1969A	Chandi Charan Bandyopadhyay
2031A	Sandip Kumar Chatterjee
2043A	Virendra Ch. Sinha
2088A	Rathindra Narayan Banerjee
2099A	Shyam Prasad Nandy
2174A	Suprakash Das Gupta
2220A	Rathindra Nath Das
2242A	Madhu Sudan Bhattacharjee
2249A	Pranab Kumar Ganguly
2256A	Biswanath Palbag
2272A	Bhakta Ranjan Saha
2296A	Sarjoo Pandey
2341A	Nirmalya Mukherjee
2348A	Jagneswar Kundu
2361A	Chittapriya Banerjee
2413A	Satyabrata Bhowmick
2434A	Sheodev Mishra
2439A	Chandramani Behera
2451A	Somanath Nanda
2452A	Kandu Charan Nayak
2453A	Kailash Chandra Mahapatra
2469A	Haladhar Panda
2475A	Nidadhubolu Gajapati
2478A	Sashi Bhusan Mahapatra
2479A	Parikshit Tripathy
2480A	Kedarnath Misra
2492A	Krushna Mohan Sundaray
2512A	Ramesh Chander Bhatia
2523A	Prafulla Chandra Chowdhury
2558A	Dandapani Gouda
2560A	Baikunthnath Senapati
2578A	Dass Kumar
2580A	Bhan Pratap Singh
2614A	Rattan Lal Bhat
2635A	Tarsem Lal Aggarwa
2655A	Rajendra Nath
2657A	Kulbhushan Chopra
2666A	Kehar Singh
2672A	Virendra Prasad
2690A	Som Prakash Bhatia
2694A	Baldev Raj
2701A	Rup Singh
2720A	Om Prakash Gupta
2747A	Parkash
2753A	Ved Parkash Maheshwari
2755A	Gurbaksh Singh Chawla
2756A	Radha Raman
2760A	Krishan Lal
2796A	Chandra Pal
2827A	Rajendra Singh
2835A	Amar Pal
2853A	B. A. Reddy
2855A	Ravinder Kumar Gupta
2872A	Ram Nath Tyagi

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A—*contd.*

Roll No.	Name of candidate
2876A	Pritam Dev Sharma
2881A	Shyam Narayan Sharma
2885A	Gopal Krishan Sawhney
2890A	Vinod Kumar
2898A	Ish Kumar Khurana
2900A	Krishan Kumar Katial
2902A	Baljit Singh Sulankhi
2933A	Ram Partap Seth
2943A	Ram Kumar
2949A	Ram Bhaj Khurana
2961A	Raj Gopal Arya
2967A	Hardip Singh
2968A	Suresh Kumar Agarwal
2971A	Subhas Chandra
2983A	Trilok Singh Grover
2984A	Vijinder Kumar Jain
3004A	Ramji Sahai Srivastava
3023A	Khem Raj Khosla
3027A	Krishan Kumar Kathuria
3048A	Krishan Kumar
3061A	M. R. Viswanatha Ayyar
3067A	G. Chandrasekhar
3073A	Inder Kumar Chhabra
3075A	Rajinder Kumar Jain
3084A	Som Prakash Kaushish
3102A	Shanti Kumar Khanna
3110A	Ratan Kumar Chakravarty
3111A	Pushp Raj Gurwara
3116A	Suresh Kumar Khanna
3139A	N. S. Vittal Rao
3140A	Gurbaksh Singh Chhabra
3166A	Gauri Shanker
3173A	Ramesh Chand Jain
3220A	Thakar Dass Sachdeva
3256A	Shiv Swarup Yadav
3329A	Vishwanath Kundanlal Nanda
3333A	Harsaran Singh Bhatia
3348A	Phool Chand Jain
3371A	Prabhakar Bhikaji Kanetkar
3375A	G. V. Kalwaney
3382A	Rajinder Singh Toor
3460A	Jagdishwar Nath Kathpalia
3461A	Arjun Dev
3474A	Jagmohan Lal Sud
3481A	Jawahar Lal Kukreja
3488A	Harbans Lal Kamra
3489A	Romesh Kumar
3507A	Shadi Lal Bhasin
3529A	Jai Pal Thakur
3532A	Mohan Lal Sareen
3535A	G. P. Agrawal
3536A	Gurcharan Singh
3539A	Amrit Lal
3540A	Mohan J. Chawlani
3544A	Priyaranjan Sircar
3552A	Daya Nand Agarwal
3688A	Jagdish Chander Malhotra
3729A	Mohinder Jit Singh Rooprai
3750A	Jagadish Chandra Dey
3758A	Muralidhar G. Vaidya
3782A	Murari Lal Khanna
3824A	H. R. Jaiswal
3828A	Rajendra P Nadar
3838A	P. Satyanarayana Murty
3845A	A. V. R. Prasada Rao
3861A	E. Sarveswar Rao
3875A	S. V. S. Bhaskara Reddy
3885A	A. Narsaiah
3892A	M. Lakshminath
3910A	Subodh Kumar Nayak
3912A	T. V. Krishna Reddy
3914A	H. K. Rama Rao
3956A	S. Shamanna
3957A	Mohan Lal
3961A	M. V. Rajeshwara Rao
3974A	D. J. Bhaskar
3979A	S. Venkateswara Babu
3981A	P. Narayana
3989A	A. V. Balachandran
3997A	N. Surya Bangaram
4005A	Mohd. Lateefuddin
4016A	Ilapakurty Satyanarayana
4081A	V. S. K. Prasada Rao
4085A	G. Swaminathan
4091A	C. Mohana Reddy
4153A	K. Narayana Murty
4198A	Prem Narain Mathur
4220A	S. D. Murty
4293A	Khushi Ajoomal Nichani
4330A	S. P. Kohli

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A—*contd.*

Roll No.	Name of candidate
4344A	K. C. Shrivastava
4361A	Mohindar Singh
4366A	Hakumat Rai Luthra
4370A	S. D. Deshmukh
4388A	Tarsem Lal
4403A	Jotram
4404A	Sangram Singh Rathore
4418A	Amar Chandra Saxena
4423A	Gurdev Singh
4424A	Hari Narain Goel
4427A	Om Prakash Wadhwa
4429A	Madan Gopal Mehta
4441A	Munshi Lal Gupta
4446A	Shiv Kumar
4450A	T. Manghnani
4465A	Rameshwar Nath
4469A	Anand Prakash Vyas
4473A	Roshan Lal Depura
4482A	Shiv Nath Bhargava
4496A	Bhava Nath Avasthi
4502A	Budhmal S. Mathur
4517A	Suraj Narain Bansal
4526A	Tulsi Das Goldsmith
4551A	Kailash Chandra Puri
4587A	Santosh Singh Panwar
4598A	Krishna Swarup Saxena
4607A	Ram Saran Gupta
4630A	Satish Kumar Mathur
4707A	K. Purohit
4711A	C. Thomas John
4712A	Y. Bala Krishna Rao
4724A	D. Rajagopalan
4740A	G. S. I. Parthasarathy
4795A	Dipak Kumar Ghosh
4804A	Sukhpal Singh
4843A	Mahesh Kumar Khurana
4844A	Vijai Krishna Gupta
4879A	Bhawani Datt Joshi
4893A	Jagtar Singh
4903A	M. V. Joshi
4916A	C. P. Agarwal
4933A	G. S. Kaushik
4952A	Krishan Kumar Dass
4963A	Anand Parkash Bhandari
4966A	Samson Franklin Fish
4967A	Mahendra Singh
4968A	Munna Lal
4975A	Rajendra Narain Srivastava
4993A	Upendra Nath Srivastava
4997A	Kanhaiya Lal Tripathi
5018A	Omkar Nath Gupta
5096A	Ram Nain Singh
5145A	Mahendra Prakash Agrawal
5184A	Ramesh Chandra Agarwal
5192A	Balvinder Singh Sindhu
5206A	B. S. Srivastava
5240A	T. D. Taneja
5251A	Yogesh Chandra Kulshrestha
5257A	Susil Kumar Mohanty
5259A	Bharat Pradhan
5260A	Dibyasingha Das
5265A	Bijoy Kumar Patnaik
5266A	Dhabaleswar Sahu
5272A	G. Kanna Rao
5280A	Bhawani Shankar Prasad Panda
5284A	C. S. Vittal
5285A	Sashi Bhushan Bantaraya
5290A	B. Mathiprakasam
5294A	Gagan Behari Nanda
5303A	K. N. Ravindar
5304A	S. Gangi Reddy
5322A	Keshab Chandra Swain
5323A	Bhabani Prasad Rath
5333A	P. Bhaskara Rao
5343A	P. K. Sankaran
5363A	R. Srinivasan
5367A	T. V. Sundaram
5369A	S. Venkatesan
5382A	G. Papa Rao
5386A	I. Vedavyasa Sharma
5387A	R. Ganesan
5396A	V. S. Prakash Rao
5400A	N. Sugavanam
5417A	R. V. Subba Rao
5425A	T. L. Ramaprasad
5440A	P. N. Bakthavatchalan
5444A	N. G. S. Iyer
5450A	P. Paja Reddy
5501A	Y. Venkata Sivudu
5553A	T. S. R. Nagarajan

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A—*contd.*

Roll No.	Name of candidate
5556A	B. Vasudeva Somayaji
5594A	T. R. Raghavan
5653A	P. Sreekumaran Thampy
5671A	Adityananda Patnaik
5694A	G. Viswanadha Raju
5723A	P. T. Dorai Raj
5730A	R. Narasimhan
5749A	G. E. Jayakumar
5755A	T. Hanumantha Reddy
5770A	T. V. Panthulu
5774A	Chittaranjan Sarangi
5777A	M. Kuppuswamy
5801A	M. V. Bhaskaran
5811A	M. K. Santhan
5835A	T. Anandakrishan
5874A	K. V. L. Narasimha Murthy
5890A	Gorti Suryanarayana
5912A	P. T. George
5927A	V. V. R. Subuddhi
5970A	T. S. Raman
5993A	Coimbatore V. Subrahmaniam
6026A	C. V. Ramanaiah
6040A	R. P. Kani
6061A	Thiruvenkatachari
6074A	S. Balakrishan
6086A	A. Kaliamoorthi
6089A	M. Viswanathan
6092A	V. S. Narasimhan
6093A	K. S. Mani
6096A	V. Krishnamurthy
6100A	Surendra Nath Naik
6101A	K. Subramanian
6103A	V. Ramaswamy
6114A	K. Ramakrishna Sarma
6125A	Mohan P. Gurnaney
6181A	Achal Kumar Datta
6193A	M. N. Khadase
6199A	D. S. Tomer
6261A	Ved Raj Goyal
6267A	Raghbir Nath Handa
6281A	Gurbachan Singh Randhawa
6285A	Narendra Kumar
6303A	Gurdial Singh Brar
6304A	Surinder Singh Bhandal
6313A	Naresh Chand Singal
6314A	Prithivi Pal Rawlley
6318A	Gurdev Singh Hans
6323A	Suraj Prasad Nigam
6327A	Prem Chander Rajput
6333A	Kanwar Sukhdarshan S. Verma
6346A	Gian Chand
6347A	Mohinder Singh Nangal
6354A	Prem Parkash Puri
6405A	B. S. Matharu
6407A	Kali Charan Dass Kapur
6422A	Dharam Pal Ghambhir
6430A	Gurmukh Singh
6477A	Prem Chand Garg
6502A	Mukhtar Singh Randhawa
6564A	Lakshmi Narain Kukreja
6571A	Krishan Kumar Verma
6612A	Bhagwan Dass Malhotra
6623A	Piara Singh
6645A	Karam Chand Seth
6674A	Sarjug Thakur
6683A	V. S. Prabhakara Rao
6686A	Liladhar Prasad Sinha
6730A	Dashrath Singh
6749A	Niharendu Mukherjee
6847A	Shankar Kumar Chatterjee
6851A	Ram Vilas Singh
6855A	D. D. Chaubey
6856A	Devendra Prasad Singh
6865A	Gopal Chandra Verma
6874A	A. Prasad
6885A	H. P. Tiwary
6923A	V. S. Engineer
6925A	A. P. Javkhedkar
6945A	M. Venkateswara Rao
6968A	Pandit Narsinha Joshi
6982A	K. Rama Varma Raja
6993A	Bhalchandra D. Dani
7003A	Muruti Baburao Patil
7007A	S. V. Bhide
7027A	S. Dutta
7034A	B. Krishnamoorthy
7035A	Ramesh Chandra Gupta
7082A	M. S. Patil
7097A	A. M. Momin
7099A	K. T. Chawala

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A—*contd.*

Roll No.	Name of candidate
7101A	Govind H. Jangle
7120A	S. S. Hachadad
7183A	R. V. Belsare
7205A	Shankar Laxman Lele
7252A	S. P. Patwardhan
7336A	Som Nath
7352A	Bansi Lal Kaul
7357A	P. Balasubramanian
7365A	G. Kesava Iyer
7366A	S. Ramaswami
7374A	P. K. Abraham
7405A	P. Jacob Kurian
7441A	K. Radhakrishnan Nair
7480A	K. Sankara Raman

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION B

Roll No.	Name of candidate
2B	Kirti Kumar Maniar
6B	H. Mohamed Yusuff
10B	Anil Natverlal Mukhtiar
18B	S. Thomas
19B	K. R. Shankar
31B	G. Jayadevappa
39B	D. S. Venkata Krishna
44B	V. P. Rama Krishnan
45B	S. Narayana Rao
46B	A. P. Krishna Murthy
56B	S. Srinivasa Murthy
60B	V. L. Narayana
68B	K. T. Ananthanarayana
75B	M. V. Ramaswamy
108B	S. T. Satyanarayana Rao
112B	P. R. Balakrishna
123B	M. R. Krishna
130B	V. K. Ramanatha
135B	V. Kameswara Sarma
137B	N. G. Gopalakrishna
153B	G. V. Nathani
156B	Nand Kishore Agrawal
157B	Ratan Jagatrai Thadani
158B	Dara J. Dubash
166B	N. R. Wadhwa
167B	S. Bashyam
169B	P. K. Dasgupta
174B	V. Nagarajan
179B	Surinder Kumar Sethi
181B	Parmanand W. Lalla
182B	N. W. Samant
184B	S. P. Dharap
187B	K. S. Sastry
193B	L. S. Krishnamurthy
194B	V. M. Prabhu
201B	Chandrakant J. Kotwala
203B	Ramchandra K. Gokhale
204B	R. D. Wagh
206B	Vinayak Raghunath Vaidya
210B	D. C. Bilandani
214B	P. S. Ramaih
224B	Pesi Jal Amaria
231B	Janardan R. Sawant
234B	V. C. Mehta
235B	B. Venkata Ratnam
249B	Moti Lal Khanna
254B	R. T. Salunke
257B	K. G. Mehta
262B	B. V. Hingorani
265B	R. Venkataraman
271B	T. Janardhana Rao
283B	Alok Ranjan Biswas
284B	Dipak Chauduri
286B	Jaydeb Sur
287B	Debabrata Chatterjee
298B	Dipendra Kumar Basu
301B	N. Ramakrishnan
303B	Sat Pal Jain
307B	Manmatha Nath Mandal
308B	Sunil Kumar Sen
310B	Prabhat Chandra Pramanik
312B	Arun Kumar Mitra
316B	Dibyendra Lal Roy
324B	Ram Narayan Ghosal
328B	Amal Kanti Nandi
329B	B. Neogi

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION B—*contd.*

Roll No.	Name of candidate
330B	Sisir Kumar Guha
331B	Biswa Nath Bhattacharyya
335B	Sankar Prosad Ghosal
337B	Sunil Kumar Dutta
338B	Birendra Kumar Ghosh
339B	Asoke Kumar Neogi
342B	Harbans Singh Bedi
350B	K. P. Misra
352B	Chandra Kanta Maity
373B	Sunil Kumar Ghosh
378B	Kamal Kumar Chatterjee
383B	C. Gopalan
386B	Sourendra Nath Chakraborty
388B	Pranab Kumar Banerjee
389B	Nilratan Banerjee
392B	Satya Ranjan Das
395B	Sanjib Kumar Datta
409B	Jogesh Chandra Paul
412B	M. B. Johari
416B	A. R. Balasubramanian
424B	S. D. Subrahmanyan
434B	Suresh Chand Gupta
452B	Prabhat Kumar Shome
457B	Brajo Gopal Banerjee
458B	Pradip Kumar Saha
475B	Sunil Kumar Banerjee
476B	Debkumar Sinha
478B	Amitava Sanyal
487B	Manoj Ghosh
492B	Sambhunath Choudhury
493B	Krishna Chandra Misro
494B	Purusottama Kar
504B	Prafulla Chandra Pati
516B	Benudhar Mahapatra
517B	Narayan Chandra Das
525B	R. Natarajan
526B	Raj Kishore Dash
527B	Bijoyanandan Mohapatra
528B	Lambodar Behera
530B	M. Krishnaswamy
533B	Charanjit Singh Chowdhry
535B	Gurcharan Singh Vohra
543B	Lakshmi Narayan Gautam
546B	Surjit Singh
547B	Rameshwar Nath
548B	Kuldipak Raj Bhatia
550B	Dina Nath Sharma
552B	G. Naganathan
556B	Narendra Lal Puri
562B	Man Mohan Sachdev
563B	Akal Mohan Singh
568B	Shiv Dhyan Singh
574B	Santa Singh Sidhu
575B	Mahesh Chandra Sharma
580B	Bhagwan Singh
581B	Randhir Singh Bhangu
584B	Sunder S. Narang
600B	Ilam Chand
601B	Bharat Bhushan
602B	Ajit Singh Bedi
604B	Devendra Kumar Goel
607B	Baljit Singh Ahluwalia
610B	Kulbhushan Kumar Suri
611B	Atam Prakash Bhartiya
612B	K. L. Balwani
616B	Sant Singh
617B	Shri Krishan Gandotra
638B	Ved Prakasha Bhatia
640B	S. K. Maheswari
646B	Arjan Singh
647B	Amar Lal
658B	Suraj Prakash Adlakha
659B	O. P. Sindhwani
664B	Om Prakash
665B	D. B. Khanduja
673B	Rajinder Kumar Garg
684B	Radhe Shyam Arora
690B	M. S. Nigam
694B	Balraj Taneja
695B	Surendra Kumar Aggarwal
697B	Shri Prakash Srivastava
700B	Mohinder Paul Merwah
701B	Munshi Ram Gulati
706B	Dharam Vir
710B	R. Srinivasan
714B	D. P. Hatwal
720B	Joginder Singh
724B	Bhagwan Dass Juneja
727B	Jagjit Saigal
731B	Satish Mohan Agarwal

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION B

Roll No.	Name of candidate	Roll No.	Name of candidate
735B	Mittar Singh Makker	1008B	J. Balasubrahmanyam
737B	Ram Raksh Pal Sharma	1012B	P. Hari Babu
743B	Gulshan Kumar Girdhar	1024B	A. C. V. Narasimha Raju
744B	Y. P. Aggarwal	1035B	K. Santhanam
745B	Tirlok Singh	1065B	N. V. Narasimha Chari
753B	B. N. Tekchandani	1067B	I. V. S. Murthy
754B	V. S. Asnani	1074B	B. S. Bhatnagar
757B	Satya Pal Singh Bedi	1075B	S. R. Satija
770B	Raj Pal Singh Nehra	1082B	Ajit Singh
773B	Rajindar Nath Talwar	1083B	N. P. Dubey
774B	G. K. Mehra	1085B	G. Venkataraman
777B	Prem Nath Suri	1090B	N. Thangaraj
783B	Krishan Sarup Guliani	1094B	Vijay Kumar
787B	Rajinder Kumar Kalsi	1096B	Gurcharan Singh
788B	Rajindar Pal Bhatia	1102B	Hari Prakash Sharma
789B	J. C. Wadhwa	1107B	Rewat Prakash Sharma
795B	Hans Raj Saini	1112B	K. J. R. Naidu
807B	Ram Bhatia	1115B	V. P. Misra
811B	Ramesh Kumar Gupta	1122B	Utsaw Lal Jain
813B	Baldev Raj	1124B	P. R. Upadhaya
814B	Jagdish Prasad Sharma	1128B	Govind Singh Charan
828B	Ramesh Mehta	1131B	Inderjit Singh Soni
831B	H. S. Luthra	1137B	A. B. Chatterjee
832B	Anand Kumar	1139B	R. Muthukrishnan
834B	Mohindar Lal	1146B	M. K. Rao
838B	Sukhmal Chand	1153B	S. R. Joshi
840B	Sumer Mal Mathur	1165B	Raj Kishor
841B	K. C. Bhatia	1166B	Raghunandan Swarup
852B	Surender Singh	1171B	S. P. Bhandari
861B	R. K. Nischal	1175B	S. G. Date
866B	Mohan Lal Khurana	1176B	Man Mohan Mittal
871B	Surjaya Kanta Tripathy	1178B	Raghuvendra Prasad
882B	Sarosh M. Khambatta	1181B	R. K. Gurtu
883B	N. Seetaramaiah	1187B	Krishna Kumar Rastog
884B	K. Ram Mohan Rao	1199B	Krishan Swarup Agarwal
894B	D. V. Subba Rao	1205B	Dharam Singh
895B	G. S. Pathak	1208B	R. N. Bhargava
897B	K. S. K. Prasad	1211B	Satish Chandra Aron
901B	B. S. Raj	1225B	R. S. Verma
921B	T. Ramanadham	1242B	B. V. Krishna Rao
923B	G. Sreeramulu Reddy	1246B	R. Vasudevan
933B	K. T. Krishnamurthy	1249B	V. S. Raju
937B	Y. L. Narasimhulu	1252B	S. R. Kannan
991B	Y. V. S. Ramamurty	1259B	A. Venugopala Rao
1006B	K. Rajesham	1264B	S. Vaidyanathan

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION B—*contd.*

Roll No.	Name of candidate	Roll No.	Name of candidate
1267B	J. R. Dhanaseelan	1511B	Krishan Chander
1271B	B. Padmanaban	1512B	Ram Sarup Mehta
1278B	R. Mohanarangan	1518B	Satya Pal
1281B	Dibakar Panigrahi	1519B	Krishan Baldev Goyal
1284B	M. V. Gopalan	1520B	C. P. Utreja
1285B	R. Ramanathan	1521B	Vishwa Nath Singla
1287B	N. Subba Rao	1522B	Gurdev Singh Uberoi
1288B	G. Venkateswara Rao	1523B	Sukhdev Singh
1295B	G. Kota Reddy	1526B	Gulzar Singh Chadha
1297B	Desu Krishnamoorthy	1527B	Rajinder Paul Singh
1300B	S. Venkatasubramanian	1532B	Ram Prashad Bhardwaj
1302B	V. Prasannan	1534B	Gurcharan Singh Toor
1305B	C. Subba Reddy	1537B	Ram Lubhaya
1311B	B. Rama Krishna Raju	1542B	Lachhman Das Puri
1312B	A. V. Madhusudhana Rao	1545B	Balbir Singh Kang
1317B	S. Kshetrapalan	1549B	Nirmal Jit Singh
1322B	Kanda Srinivas	1553B	Pyara Singh
1339B	D. Krishna Murty	1555B	Sat Pal Verma
1356B	S. Pakkiriswamy	1556B	Rabindar Lal Puri
1360B	V. R. Varadarajan	1557B	Piara Lal Goel
1382B	V. V. S. Rama Rao	1558B	Tej Parkash Goyal
1402B	K. Ramreddy	1559B	G. S. Nagi
1416B	K. V. Narasimha Rao	1563B	Kundan Lal Nagar
1422B	G. Sivarama Raju	1569B	J. N. Prasher
1425B	V. Haridoss	1570B	Bhagwan Dass Parricha
1430B	Maddi Narasimha Rao	1575B	Bishan Dass Khera
1438B	M. A. Hafeez	1581B	Gurdial Singh Premi
1439B	G. V. Krishna Moorthy	1582B	Ram Singh
1441B	Banamali Das	1583B	Pran Nath
1442B	S. Krishnaswami	1590B	Rajendar Kumar Sharma
1443B	V. Thirunarayanan	1592B	Ram Prasidh Pandey
1444B	A. V. Subramanian	1595B	Madan Singh
1446B	S. Seshadri	1600B	Md. Nazir Ali
1451B	Krishna Pradhan	1601B	Laljee Sah
1452B	Saroj Ranjan Patra	1605B	G. S. Rupal
1455B	Susil Kumar Subodhi	1624B	M. B. Ghatpande
1465B	D. S. Anjaneyulu	1625B	I. K. Nihalani
1484B	Kailash Prasad Gour	1627B	Ghaisas Madhav Shridhar
1486B	S. V. Kale	1632B	Daljit Singh Madan
1487B	K. Raman	1640B	Raghunath G. Kale
1489B	V. K. Sidharthan	1643B	Shivaji S. Takbekar
1493B	C. Sreeramulu	1650B	Prabhakar Vinayak Atre
1503B	B. K. Gupta	1653B	T. N. Ahire
1504B	Raj Paul Bhatia	1659B	Vilas Kashinath Sanap
1506B	Devender Dutta	1662B	S. P. Hiremath
		1665B	S. Dhawan

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION B—*contd.*

Roll No.	Name of candidate	Roll No.	Name of candidate
1672B	M. S. Seetharaman	1693B	A. K. Sasidharan Nair
1682B	M. M. Vban Rao	1709B	Kunnikkal Surendran
1688B	P. Thankachan	1726B	V. Sreenivasarao

OBITUARY

The sympathy of the Institution is extended to the relative of those whose passing is recorded here

R. K. Banerjee

Shri R. K. Banerjee, A.M.I.E., died on July 2, 1962, at the age of 72.

Shri Banerjee had his engineering education from the Civil Engineering College, Shibpur. After practical training in the Buildings Department of Martin and Co., he worked for two years in Cape Copper Co. and was responsible for the construction of a light railway from the Rakha mines factory to the B. N. Railway siding. He joined the Tata Iron and Steel Co. Ltd. as Surveyor and General Assistant in 1913 and retired as Assistant Refractories Engineer in 1956.

Shri Banerjee joined the Institution as Associate Member in 1941.

Shri T. Narayana Rao

Shri T. Narayana Rao, B.Sc. (Eng.), M.I.E., expired on June 4, 1962, at the age of 54.

Having obtained the B.Sc. degree in Electrical and Mechanical Engineering of the Banaras Hindu University in 1934, he joined the services of the Electricity Department of the Government of Madras in 1936, as a Junior Engineer. He was promoted to the rank of Superintending Engineer in 1954, and continued to hold this post until his death. During his professional career, he was responsible for several construction works in connection with generation, transmission, distribution and utilization of electrical power in Madras State.

Shri Narayana Rao joined the Institution as Member in 1958.

Shri K. Sitaraman

Shri K. Sitaraman, B.E.(Hons.), M.I.E., died on September 2, 1962, at the age of 43.

Born in October 1918, Shri Sitaraman had his engineering education in the Engineering College, Guindy, Madras, where he took his Civil Engineering degree with honours. He secured the second rank in the I.R.S.E. competitive examination in 1941 and joined the then G.I.P. Railway as Assistant Executive Engineer at Bhusaval. His first major intricate assignment was in 1945 in the Lonavla-Karjat and Kasara-Igatpuri sections of the Central Railway on the removal of infringements on the Bhore and Thull Ghats. Later in 1948, he was in charge of construction of the doubling of the 16 mile Budni-Barkhera main line across the Vindhyas extending for a period of five years. He was associated with laying of the new 187 mile metre gauge line from Khandwa to Hingoli. He also gave considerable help in the designing of the new Byculla Railway Hospital. His services were loaned to the Tata Power Co. Ltd., as Project Engineer for the Bhira New Tunnel Project near Poona on which he worked till his death. He was re-named Deputy Chief Engineer, Central Railway (on foreign service with Tata Power Co. Ltd.). He contributed several technical articles in his field and was joint author with Shri N. M. Thadani of a paper entitled 'Building a Mountain Railway Across the Vindhyas—Construction of the New Down Line Between Budni and Barkhera' (*Journal*, vol. 34, no. 4, June 1954), which was awarded the Railway Board Second Prize for 1953-54. He was also Associate Fellow of the Permanent Way Institution, London, and member of the American Concrete Institute and American Society of Civil Engineers.

Shri Sitaraman joined the Institution as Associate Member in 1950, and was transferred to Member in 1960.

EMPLOYMENT SERVICE

This service is intended for the benefit of members of the Institution and for the Government, industrial and other organizations employing engineers. It is hoped that the employers will make full use of this service to obtain their requirement.

A small charge of Rs. 5 per insertion will be made to members for notices appearing in the 'Situations Wanted' column.

In the 'Situations Vacant' column a charge of Rs. 2 per line will be made.

Replies to advertisements should be addressed to Employment Service, The Institution of Engineers (India), P. O. Box No. 669, Calcutta 20, except where otherwise stated.

SITUATIONS WANTED

MECHANICAL ENGINEER, A.M.I.E., with four years experience as Lecturer in Polytechnic, five years as Workshop Superintendent, and one year as Head of Department of Mechanical Engineering in a Polytechnic; holding Class I post; age 37 years; seeks change in Government or private organizations. Salary expected Rs. 600. (Office ref. E.S. 111)

ARMY ENGINEER OFFICER, B.E. (Civil), M.I.E., 7 years in P.W.D., Bengal, and 21 years in Corps of Engineers, will be available from March 1, 1963, for administrative and/or construction works; has experience in the construction of R.C.C. bridge on wells, six-storey buildings, stores, sheds, bunker magazines, hospitals, schools and colleges, administrative buildings, swimming pool, concrete tennis court, seawall, overhead and underground R.C.C. reservoirs, tarmac and concrete roads, sewage disposal, external and internal electrification and water supply, air conditioning, and installation of lifts, and has framed and administered many contracts large and small. (Office ref. E.S. 109)

CHARTERED ELECTRICAL ENGINEER, B.E.E., A.M.I.E.E., A.M.I.E., worked with a firm of British Consulting Engineers on power engineering in the U.K., and in India for more than 10 years; also worked in collieries, iron and steelworks and steel rolling mills, desires to join a firm of Consulting Engineers. (Office ref. E.S. 110)

ELECTRICAL ENGINEER, B.Sc. (Hons.), B.Sc. (Elect. Eng.), A.M.I.E., 1st class boiler engineer, aged 34 years, with a post-graduate, with experience of nine years in generation and distribution of power, repair and maintenance of turbo-alternators, water tube boilers, power transformers, a large number of different types of motors with switchgears, automatic and variable speed controls, installation of electrical equipments of modern machines in big reputed concerns, seeks a change for a suitable position of responsibility in a reputed concern on a basic salary of Rs. 1,000 or more. (Office ref. E.S. 112).

THE BULLETIN
OF
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SECRETARY & EDITOR: B. SESHADRI, B.Sc., A.I.I.Sc., D.I.C., M.Sc.(Eng.), M.I.E.

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FORTY-THIRD ANNUAL CONVENTION
BANGALORE
FEBRUARY 2-9, 1963

PROGRAMME OF PAPER MEETINGS AND SYMPOSIA

The programme of the 43rd Annual Convention, Bangalore, February 2-9, 1963, was published in the October issue of the *Bulletin*. The Paper Meetings and Symposia will be held during the Annual Convention on February 4-5, 1963, as detailed below.

Engineering Division/Group	February 4, 1963		February 5, 1963	
	9.00 a.m. to 1.00 p.m.	2.00 p.m. to 5.00 p.m.	9.00 a.m. to 1.00 p.m.	2.00 p.m. to 4.00 p.m.
Civil	Paper Meetings		Symposium	
Mechanical	Symposium			
Electrical		Paper Meetings	Symposium	
General		Paper Meetings		Symposium
Chemical			Paper Meetings	
Electronics and Telecommunication	Paper Meetings			
Mining and Metallurgy	Paper Meetings			
Public Health		Paper Meetings		
Structures Group 1		Paper Meetings		
Structures Group 2	Paper Meetings			
Roads and Road Transportation		Paper Meetings		
Industrial Engineering		Paper Meetings		
Marine Engineering and Shipbuilding	Paper Meetings			

No Paper Meetings are being arranged in the Railway Engineering, Aeronautical Engineering and Nuclear Engineering Groups as the Chairs of these Groups are vacant at present and there are no papers for discussion. A popular lecture will be given at 3.00 p.m. on Sunday, February 3, 1963, in place of 'Addresses by Chairmen and Paper Meetings' as published on P4 in the October *Bulletin*.

Schedule for Paper Meetings and Symposia

February 4, 1963, 9.00 a.m. to 1.00 p.m.

Civil Engineering Division

Paper Meetings

(1) Address by Prof. N. S. Govinda Rao (*M.*), *Chairman*

(2) 'Foundation Exploration at Nagarjunasagar Dam' by R. C. Rao (*A.M.*) (*Journal*, vol. 42, no. 7, pt. CI 4, March 1962)

(3) 'Plant Selection and Layout with Special Reference to Rihand Dam' by A. N. Rau (*A.M.*) (*Journal*, vol. 42, no. 7, pt. CI 4, March 1962)

(4) 'Hydraulic Jump Stabilization' by K. Seetharamiah (*M.*) and A. S. Ramamurti (*Non-member*) (*Journal*, vol. 42, no. 7, pt. CI 4, March 1962)

(5) 'Determination of the Elements of Hydraulic Jump in Trapezoidal Channels' by Prof. R. M. Advani (*M.*) (*Journal*, vol. 42, no. 9, pt. CI 5, May 1962)

(6) 'The Port of Calcutta—Problems and Solution' by D. Mookerjea (*M.*) (*Journal*, vol. 42, no. 11, pt. CI 6, July 1962)

(7) 'Planning for Flood Control Legislation' by Moshin Ali (*Life Member*) (*Journal*, vol. 42, no. 11, pt. CI 6, July 1962)

(8) 'Design of Reinforced Concrete by Plastic Theory' by (*Shrimati*) Shakuntala Bhagat (*A.M.*) (*Journal*, vol. 43, no. 3, pt. CI 2, November 1962)

Mechanical Engineering Division

(1) Address by Shri T. R. Gupta (*M.*), *Chairman*

(2) Symposium on 'Automation in Industry'

Electronics and Telecommunication Engineering Division

Paper Meetings

(1) Address by Dr. A. K. Chatterjee (*M.*), *Chairman*

(2) 'Telecommunication Networks on Indian Railways—Progress and Problems' by B. V. Sreenivasiah (*A.M.*) (*Journal*, vol. 42, no. 9 pt. ET 3, May 1962)

(3) 'Transistor *R-C* Oscillators' by V. P. Sinha (*Non-member*) (*Journal*, vol. 42, no. 5, pt. ET 2, January 1962)

(4) 'Simulation of Third Order Systems with a Lead and a Time Constant Using One-Operational Amplifier' by L. K. Wadhwa (*Non-member*) and H. S. Rao (*Non-member*) (*to be published*)

(5) 'Simulation of Third Order Systems with One-Operational Amplifier' by G. K. Aggarwal (*Non-member*) and L. K. Wadhwa (*Non-member*) (*to be published*)

(6) 'Telegraph Codes for Phonetic English Alphabet' by S. Balaram Rao (*A.M.*) and S. Raghunatha Rao (*Non-member*) (*to be published*)

Mining and Metallurgy Division

Paper Meetings

(1) Address by Dr. M. N. Dastur (*M.*), *Chairman*

(2) 'A Discussion on the Reduction of Silicon Dioxide in Blast Furnace' by A. T. Pal (*A.M.*) (*Journal*, vol. 42, no. 11, pt. MM 3, July 1962)

(*Further details to be announced later*)

Structures Group—2 : Shell Structures

Paper Meetings

(1) Address by Shri G. S. Ramaswamy (*M.*), *Chairman*

(*Details to be announced later*)

Marine Engineering and Shipbuilding Group

Paper Meetings

(1) Address by Shri S. Basu (*M.*), *Chairman*

(*Details to be announced later*)

February 4, 1963, 2.00 p.m. to 5.00 p.m.

Electrical Engineering Division

Paper Meetings

(1) Address by Prof. M. V. Deshpande (*M.*), *Chairman*

(2) 'Design of Electrical Power Machines' by S. H. Raj (*A.M.*) (*Journal*, vol. 42, no. 6, pt. EL 3, February 1962)

(3) 'Possible Criteria for Determining the Condition of Lightning Arresters' by V. Prabhashanker (*Non-member*), S. H. Hubli (*Non-member*) and Prof. D. J. Badkas (*A.M.*) (*Journal*, vol. 42, no. 8, pt. EL 4, April 1962)

(4) 'Some Aspects of Electrical Development in Andhra Pradesh' by B. P. Sastry (*A.M.*) (*Journal*, vol. 42, no. 8, pt. EL 4, April 1962)

(5) 'Predetermination of Electrical Characteristics of Steel Tubes at Power Frequencies' by Dr. H. R. Chablani (*A.M.*) (*Journal*, vol. 42, no. 10, pt. EL 5, June 1962)

(6) 'Some Research Problems in Electrical Apparatus' by Prof. M. V. Deshpande (*M.*) (*Journal*, vol. 42, no. 10, pt. EL 5, June 1962)

(7) 'Analysis of A.C. Magnetic Field in the Nonlinear Region at Very Low Frequencies' by R. C. Pal (*A.M.*) (*Journal*, vol. 42, no. 12, pt. EL 6, August 1962)

General Engineering Division

Paper Meetings

(1) Address by Shri R. N. Joshi (*M.*), *Chairman*

(2) 'Apprenticeship Training in Industry' by Dr. N. S. Nandeeswaraiya (*M.*) (*Journal*, vol. 42, no. 8, pt. GE 2, April 1962)

(3) 'Scheme of Cost Reduction' by T. S. Vedagiri (*Non-member*) (*Journal*, vol. 42, no. 8, pt. GE 2, April 1962)

(4) 'Management and Administration of Engineering Activities and Their Impact on the Country's Development Programme' by Prof. R. M. Advani (*M.*) (*Journal*, vol. 42, no. 12, pt. GE 3, August 1962)

(5) 'Efficiency in Civil Engineering' by Richard Pfenniger (*M.*) (*Journal*, vol. 42, no. 12, pt. GE 3, August 1962)

Public Health Engineering Group

Paper Meetings

(1) Address by Shri R. S. Mehta (*M.*), *Chairman*

(2) 'Methods of Disposal of Radioactive Wastes' by M. Ansari (*A.M.*) (*Journal*, vol. 42, no. 5, pt. CI 3, January 1962)

(3) 'A Comparative Study of the M.P.N. and Membrane Filter Techniques for Bacteriological Examination of Drinking Water' by Prof. S. J. Arceivala (*A.M.*) and R. Pitchai (*A.M.*) (*Journal*, vol. 42, no. 11, pt. CI 6, July 1962)

Structures Group 1—Prestressed Concrete Development

Paper Meetings

(1) Address by Shri N. N. Purandare (*M.*), *Chairman*

(*Details to be announced later*)

Roads and Road Transportation Group

Paper Meetings

(1) Address by Shri H. P. Mathrani (*M*), *Chairman*)

(2) 'Dense Graded Asphaltic Paving Mixture' by K. S. Sankaran (*A.M.*) (*Journal*, vol. 42, no. 9, pt. CI 5, May 1962)

(3) 'A Study of Indian Blast Furnace Slag as Road Aggregate' by I. P. Khanna (*Non-member*) and V. Venkatasubramanian (*A.M.*) (*Journal*, vol. 42, no. 11, pt. CI 6, July 1962)

(4) 'Subgrade Theories in Design of Concrete Pavements' by N. K. Vaswani (*A.M.*) (*Journal*, vol. 42, no. 9, pt. CI 5, May 1962)

(5) 'Traffic Accidents and Their Specific Problems in Assam' by G. C. Sharma (*M.*) (*Journal*, vol. 43, no. 5, pt. CI 3, January 1963)

Industrial Engineering Group

Paper Meetings

(1) Address by Shri R. M. Patri (*M.*), *Chairman*

(2) 'Use of Time Span Instrument in Job Analysis and Measurement of of Responsibility' by Prof. R. Mishra (*M.*) and R. Banerjee (*Non-member*) (*Journal*, vol. 42, no. 8, pt. GE 2, April 1962)

(3) 'Comparative Evaluation of Fundamental Motion-Time Systems' by N. K. Datta (*A.M.*) (*Journal*, vol. 42, no. 12, pt. GE 3, August 1962)

(4) 'Occupational Health Research in India with Special Reference to Psychological Research' by H. C. Ganguli (*Non-member*) (*to be published*)

(5) 'Performance Sampling Study of Long Cycle Repetitive Jobs' by George Stephenos (*Non-member*) and N. K. Datta (*A.M.*) (*to be published*)

February 5, 1963, 9.00 a.m. to 1.00 p.m.

Civil Engineering Division

Symposium on 'Engineering Construction and Materials'

Electrical Engineering Division

Symposium on 'Anologies in Engineering'

Chemical Engineering Division

Paper Meetings

(1) Address by Dr. V. M. Dokras (*M.*), *Chairman*

(2) 'Adiabatic Extrusion of Thermoplastics' by Prof. M. V. Joshi (*A.M.*) and K. A. T. Varghese (*Non-member*) (*Journal*, vol. 42, no. 6, pt. CH 2, February 1962)

(3) 'Introduction of Two Basic Factors (Q_b and T_c) in the Design of Combustion Furnaces' by A. K. Shaha (*M.*) (*Journal*, vol. 42, no. 6, pt. CH 3, June 1962)

(4) 'Study of Primary Air Entrainment in Gas Jet Burners' by G. S. Davies (*Non-member*) and S. G. Mukherjee (*Non-member*) (*Journal*, vol. 43, no. 2, pt. CH 1, October 1962)

February 5, 1963, 2.00 p.m. to 4.00 p.m.

General Engineering Division

Symposium on 'Some Aspects of Engineering Education : (i) Do We Need More Engineering Colleges ? (ii) Fits and Misfits Amongst Engineering Students ; (iii) Desirability of Assessment of Teamwork in Engineering Institutions ; and (iii) Suggestions on Reorientatian of Technical Education in View of the Present National Emergency'

ARTIFICIAL STIMULATION OF RAIN-BEARING CLOUDS

Prof. S. K. Ghose
Member

Rainmaking is no longer a new science. The keen interest aroused by problems of modification of the weather and, particularly, in producing rains when needed, has inspired many scientists all over the world to conduct research on the basic factors controlling the weather and on the possibility of 'controlled' rainmaking where and when needed.

Continued experiments and carefully controlled researches carried out in this field have given rise to a new branch of physics named 'cloud physics'. The results so far obtained in the study of the microphysics of clouds have proved to be extremely promising and have emphasized the possibility of successful intervention in atmospheric phenomena by man for agricultural, hydro-electric, forest-fire control, skiing, winter sports, and other human activities. One of the results of these studies has been the use of handy rockets as nucleating agents for seeding clouds with suitable chemicals from the ground. By this method of direct firing into the clouds, the previous hit or miss methods are likely to become obsolete.

Before explaining the rocket technique, it will be desirable to explain the accepted theories about rain or hail formation.

Formation of clouds

The air below the troposphere (up to about 7 miles roughly) contains a certain percentage of moisture, depending upon thermal and pressure variations, wind, etc. When the moisture content exceeds the saturation point, the moisture which is in the form of vapour is transformed into innumerable cloud droplets (minute particles of water of different sizes) when the temperature inside the cloud is above zero, and into the solid state, *i.e.*, snow flakes or hail, when the clouds are supercooled or colder than 0°C.

Such transformations take place when the air contains nuclei or particles such as smoke, sand grains, pollen, etc. These are technically described as 'condensation nuclei'. Such nuclei are normally present in considerable quantities, the number varying from place to place, and according to the height chosen from the ground.

A cloud is thus composed of many droplets having different radii, since the sizes of the nuclei on which they have condensed are also different. Because of their extreme smallness (of the order of 0.1 μ), they remain suspended in the air, and even if they are cooled to temperatures below zero, they tend to remain in their liquid state for a long time for several reasons.

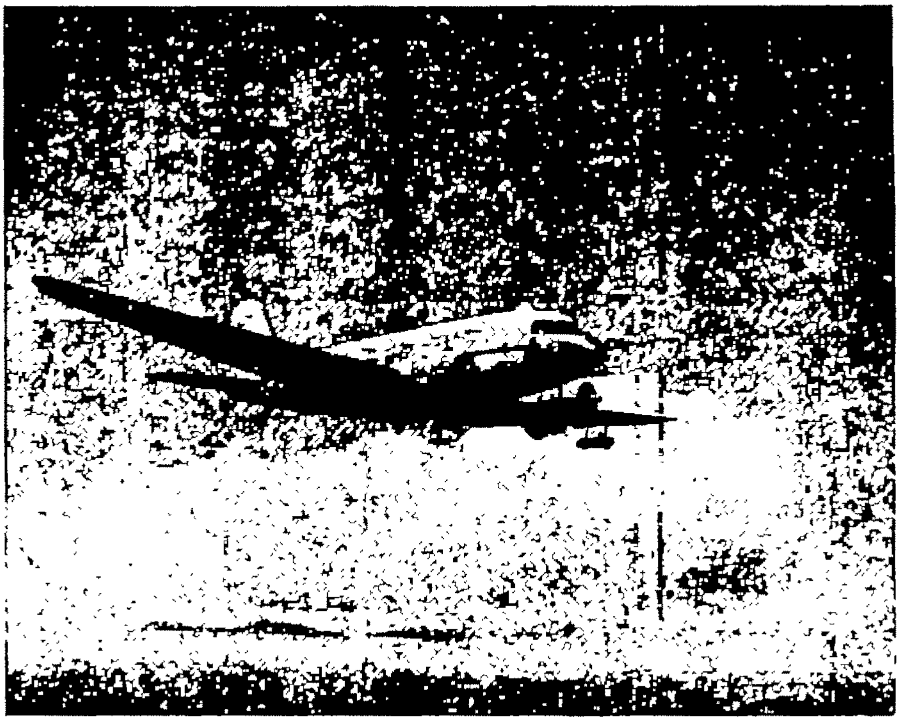
Rain falls only when an instability is produced among the various elements of a cloud, which, comparatively speaking, tends to remain stable and does not produce rain.

The processes causing the necessary imbalance are mainly two, depending upon whether the temperature inside the cloud parcel is above or below zero.

Rainfall from cold clouds

Cold clouds are formed partially from supercooled water droplets (*i.e.*, minute drops in the liquid state at temperatures below zero) when such a supercooled droplet comes in contact with a tiny ice crystal, or with something almost similar to it. It is then transformed immediately into ice. Due to the pressure of saturation and the collisions amongst practicles having different densities, ice crystals grow very rapidly, coalescing tens of thousands of cloud-droplets until they turn into snow-flakes. These start falling in the form of snow or hail. But if they melt before reaching the ground, then we have a rainfall instead of snow or hailstones.

According to Tor Bergeren, such a mechanism works when ice crystals or something almost similar to them are present inside the supercooled clouds. Substances which are similar to them in crystal lattice structure are called 'freezing nuclei' and amongst the many salts, etc., which have been tried as 'freezing nuclei', silver iodide has so far given the best results for seeding of cold clouds.



(*Courtesy C.S.I.R.O., Australia*)

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[C.S.I.R.O., Australia can proudly claim the honour of building up flying rainmaking laboratories (on the lines of their flying doctors). These aircraft are fully equipped for accurate measurement of all relevant meteorological data during actual flight. The instruments have been perfected in Dr. E. G. Bowen's C.S.I.R.O. Radiophysics Division Laboratories at Sydney University by a team of cloud physicists.

Rainfall from warm clouds

The other method of producing imbalance in clusters of cloud of water droplets which do not freeze is known as the 'warm cloud process'. This process is of particular interest to us as clouds over Indian plains do not reach the freezing level, particularly, during summer and monsocn months.

Cloud droplets usually remain stable, because generally their sizes do not vary greatly among themselves. But if due to some reason there are some larger droplets present, their relative movement in the up and down directions will differ from that of the smaller droplets. In this way, the larger ones catch, by collision, a considerable number of smaller droplets. Such 'giant' drops grow rapidy by 'coalescence', and soon their sizes become so big that they start falling down. During the fall, they break up and the new drops start growing bigger in their turn after coalescing with other droplets. Again they break up, and in this way, a chain reaction is set up which leads to considerable rainfall.

The larger droplets are generally formed by 'giant nuclei' amongst the condensation nuclei which are mostly formed of sodium chloride. These large nuclei usually come from the oceans in the natural way.

By utilizing the above knowledge, man has been trying to stimulate clouds artificially by seeding with giant condensation nuclei inside warm clouds, resulting in large droplets which lead to the imbalance and rainfalls.

Sodium chloride rockets

In Italy, Switzerland, France and in regions having a warm or a tropical (temperate) climate, the most suitable clouds for producing rains artificially are the 'warm type' clouds.

Experiments in rainmaking have been conducted in India and abroad by seeding warm clouds with sodium chloride sprayed from the ground or from aircraft.

Ground-seeding is feasible when there is considerable updraught from near the ground which can carry the nucleating agents up inside the body of the cloud, but such favourable conditions are rare.

The alternative method of seeding from the air is very costly, hazardous, and on occasions, impracticable, as aircraft cannot enter inside turbulent clouds without considerable risk, and it may not be possible to send up a plane quickly enough to take advantage of favourable cloud formations.

Only seeding by rockets makes it possible to introduce active nucleating substances into clouds irrespective of their nature, orographic situation and other conditions.

Usually such rocket heads contain about 600 gm. of finely powdered sodium chloride (common salt) suitably treated. The salt particles are thus sprinkled inside the clouds at a height of about 1,500 to 2,000 m. by the explosion of gunpowder charges. In this way, the hygroscopic sodium chloride particles are diffused inside the clouds mixed up by the up and down droughts invariably working inside such clouds.

The physico-chemical characteristics and the sizes of these particles cause the formation of the giant-size droplets which stimulate the precipitation mechanism.

(*Courtesy C.S.I.R.O., Australia*)

[The silver iodide (solution in acetone) is being filled in the container for feeding the AgI burner suspended from the wing of the flying laboratory. These aircraft usually do not fly through the clouds to avoid flying hazard due to excessive turbulence inside the billowing clouds. Such flying AgI nuclei generators are much more effective than the ground-based generators used by American rainmakers.]

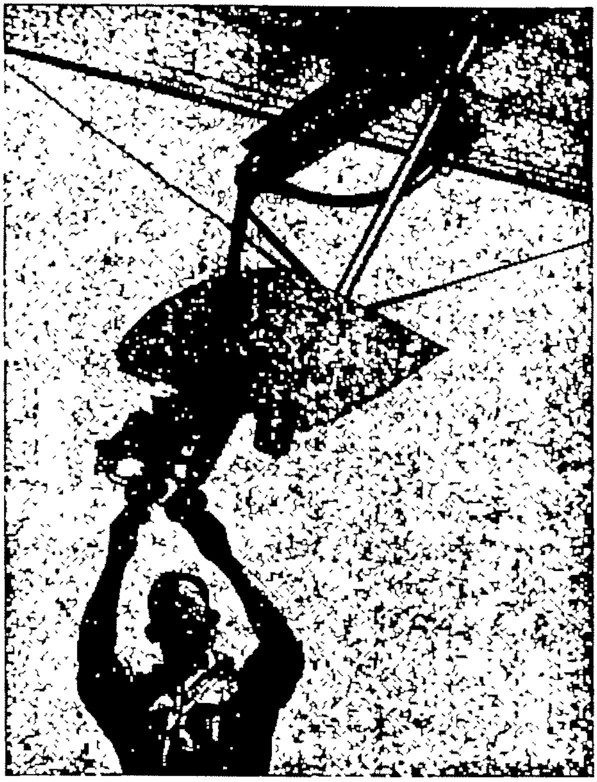
Which clouds to seed?

Only such clouds give rain which have up and down droughts, *i.e.*, cumuliform clouds such as cumuli, stratecumuli, towering cumuli, congested cumuli and cumulonimbus. Chain reaction usually takes place when such clouds are at least one thousand meters in depth.

Cumulus clouds usually have 'cauliflower' or rounded shapes and their brilliant white forms against the azure background of the sky make them conspicuous; and the bottom portion of such clouds are seen to be of a darker hue, and this is due to the heavier concentration of larger size droplets having a greater 'cloud density' or increased liquid water content per litre of cloud.

It is always advisable to inject sodium chloride by means of rockets into the base of such clouds which is generally between 1,000 to 2,000 m. and is therefore within the firing range of the rockets.

Before firing them, it is desirable to ascertain the relative humidity of the air near the ground so that it is not too low. Precipitation, natural or stimulated, cannot fall to the ground if the intervening air is too dry, in which case the drops evaporate back into the atmosphere.



(Courtesy C.S.I.R.O., Australia).

[The rainmaking research aircraft is being fitted with instruments for measuring liquid water-content of clouds, and other basic data to be collected by this flying laboratory of the C.S.I.R.O., Australia, operating from the R.A.A.F. Aerodrome at Richmond.]

Time of occurrence of rains after seeding

According to Ludlam (1951), rain should appear about 20 to 30 min. after seeding, while Bowen (1952) suggests that it may take 20 to 50 min. before rain appears. Davies (1955) states that in tropical cumulus clouds in East Africa, rain should be expected to fall about 14 to 30 min. after seeding. During the 1953-54 experiments at Amboseli and Dedoma (Davies, 1955), the time which elapsed between seeding and the first appearance of rain varied from 13 to 38 min. If we neglect the cases when the seeded cloud amalgamated with previously seeded cloud, the time which elapsed between seeding and the first appearance of rain varied from 3 to 37 min. A significant feature is that on about half the occasions rain first appears after a lapse of 10 to 16 min. On 70% of the occasions when rain appeared after a lapse of

8 min. or less, the rain intensified after a further interval of time. Therefore, even if some of the seeded clouds might have rained naturally, it is fairly certain that the seeding made the rain more intense. The seeding time and the final appearance of rain in these experiments was much less than Ludlam's and Bowen's estimates and also less than the results obtained in the 1953-54 experiments. It may, however, be pointed out that in the Australian experiments (Bowen 1952), the time between seeding and the first appearance of rain varied from 5 to 43 min., with an average value of 19 min. Bowen reported that the early appearance of rain was usually from the shallower clouds. A possible explanation of the earlier appearance of rain in these experiments may be the instantaneous and wide dispersal of sodium chloride and the increase of turbulence within the cloud, produced by the passage of the rocket. Experiments in Italy and Switzerland also support the above findings.

Conclusions

Although the experiments, carried out so far are not finalized, certain conclusions can however be drawn.

(a) The rocket technique is a very efficient and accurate method of seeding and compares very favourably with seeding by aircraft. In one respect, it is better than aircraft seeding, since the development of the seeded cloud can be watched for a long time;

(b) Sodium chloride appears to be one of the most efficient seeding agents for use in tropical regions like India where the process of coalescence is of greater significance than it is in colder regions; and

(c) Seeding of suitable clouds nearly always induces precipitation, but one cannot be sure that the seeded cloud would not have rained naturally. It appears fairly certain, however, that practically all the seeded clouds rained earlier and more heavily than they would have done naturally, and that cloud seeding is a practical method of increasing the rainfall over a specified area.

Considerable work has to be carried out in the field of cloud seeding and it would be better to try further experiments using the rocket technique which is economical. Preferably, the experimental site should be free of marked topographical effects, and complete upper atmospheric data for the region should be obtained for getting the best practical results.

In India, the irrigation research stations should definitely focus their attention to the clouds overhead and thus help in meteorological advancement in evolving better techniques of rainmaking by trying out experiments under different conditions.

References

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2. D. A. Davies, D. Hepburn and H. W. Sansom. 'Memoirs of East African Metereological Department'. Vol. 2, no. 9, 1951.

3. H. T. Orville. Final Report of the Advisory Committee on Weather Control, vols. 1 and 2, December 1957.

4. B. J. Mason. 'Physics of Clouds'. *Oxford University Press.*

5. Technical Note No. 13, World Metereological Organization, 1955, p. 19.

6. S. K. Ghose. 'Review of Rainmaking in India and Abroad'. *Proceedings of the Symposium on Artificial Rainmaking*, New Delhi, February 1952.

7. A. K. Roy. 'Possibilities of Rainmaking in India'. Report of the National Physical Laboratory, New Delhi, October 1960,

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Summaries of Papers Published in the Journal, vol. 43, no. 3, pts. CI 2, ME 2, MMI November 1962

CIVIL ENGINEERING DIVISION

Flood Control Measures with Special Reference to the Role of Reservoirs for the Solution of Flood Problems

Prof. R. M. Advani
Member

Floods are amongst the most destructive forces of nature causing enormous damage to crops and property, and quite often taking a heavy toll of human and cattle life. In this paper, mention is made of the different flood control measures such as (i) construction of embankments, (ii) river training, (iii) construction of flood storage, detention, diversion and modern dams, (iv) afforestation, and (v) soil conservation measures in the catchment areas. Mention is also made of the steps to obviate flood damages.

Reservoirs in Controlling Floods

R. B. Chakravarty
Member

Flood control schemes should be so drawn up as to make them possible of being integrated in schemes of the future. The role of reservoirs and dams in controlling floods has been dealt with in this paper.

Role of Reservoirs in the Solution of Flood Problems

B. Maitra
Member

Reservoirs play a very important role in the control of floods of a river by reducing its peak discharge. The extent of this reduction depends on the safe carrying capacity of the reaches below the reservoir. The estimation of the safe carrying capacity which depends on the present capacity of the river within its banks however cannot remain permanent for all times. This is affected by the changes in the river regime that would be brought about by the construction of reservoirs. Again, determination of the storage capacity of the reservoir and also the safe carrying capacity of the river below the reservoir would depend on the estimated frequency of a particular heavy storm. This is influenced on many variables and the expected frequency of the heavy storm in consideration has to be estimated on the basis of metereological data covering a few years. It can never be certain that a past record on which the design has been based will not be surpassed. These being the inherent limitations in the estimation of storage capacities of reservoirs and the safe carrying capacity of the river below, it is apparent that reservoirs cannot be expected to rout all possible floods to a safe limit, though they will do so in most cases.

Role of Reservoirs in Flood Control

P. H. Vaidyanathan
Member

In analyzing the usefulness of reservoirs for flood control, a brief appraisal of the present methods adopted for flood control measures has been made in the paper. It is indicated that by the very nature of the origin and course of a river in a valley, complete protection against floods is not possible with reservoirs alone. The role of reservoirs in the circumstances is limited only to a partial protection against floods.

Seismic Design of Earth Dams

A. N. Harkauli
Associate Member

A method of stability analysis of a homogeneous embankment of on earth dam for earthquake forces is presented. The effect of the earthquake on the various properties of the soil that enter into the stability analysis, and the effect of the foundation materials and their depth on the earthquake forces are discussed. The general design considerations affecting the selection and placement of materials in a zoned earth dam are mentioned.

Design of Trash Rack Structures*

M. Kothandaraman

Associate Member

Trash rack forms an integral part of the intake structure of hydro-electric power plants. The type, shape and size of a trash rack depend on its accessibility for repairs, the size and the amount of trash expected, and the fluctuations in the reservoir level. In this paper, the basis for hydraulic design of the trash rack and its supporting structure is briefly explained, and calculations are given to illustrate the method of design.

Ultimate Load Design of Reinforced Concrete

(Shrimati) Shakuntala Bhagat

Associate Member

The paper explains the principles of ultimate load design of R.C. members, and gives a few illustrations of members under bending and members under direct load and bending. In the latter part of the paper, the prevailing trend of thought on topics such as (a) shear, (b) cracking and (c) deflection is summarized. Reference is also made to the method of ultimate load design of R.C. structures.

Optimum Design for the Scroll Case of a Reaction Turbine

D. S. Srinivasa*

Non-member

A formula for the hydraulic design of scroll cases is presented in this paper. The formula is derived taking into consideration the secondary flow in the boundary layer in the scroll casing. The design method proposed ensures minimum frictional losses in the scroll casing and an equitable distribution of inflow to all the runner blades.

MECHANICAL ENGINEERING DIVISION

Some Aspects of Programming a Machine Tool

S. K. Basu

Associate Member

Considerable advance has been made in recent years in the field of programme controlled machine tools, offering tremendous scope for achieving higher rates of production.

An attempt is made in this paper to discuss the various systems of automatic control of machine tools with particular reference to programming by magnetic tape and numerical means. The author has also shown with the help of circuit diagrams the principle of automatic working of a horizontal drilling machine through various systems of electrical control.

Numerous are the techniques of control of machine tools, but the paper is limited to the discussion of a few specific cases of centralized programme control and essential functioning of feedback systems.

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* Held over from the Civil Engineering Division Part of the *Journal* for July 1962.

Analysis of Self-induced Vibration During the Process of Metal Cutting

Dr. Ing. S. G. Bhattacharya

Non-member

Self-induced vibration in metal cutting, popularly known as 'chatter' originates from the metal cutting process itself.

This paper explains the cause of this phenomenon by analyzing the basic mechanics of the metal cutting process. The analysis reveals that the measured cutting forces are influenced to a great extent by the external frictional forces at the chip-tool interface and the work-tool interface. These frictional forces are difficult to be separated from the measured forces.

The behaviour of the frictional forces are explained by resolving the cutting forces in a new force system and expressing the force relationship mathematically. Conditions are then found to exist for separating the frictional forces from the measured forces, and the characteristics of these frictional forces may be determined under different cutting conditions.

These frictional forces are observed to excite self-induced dynamic forces. These dynamic forces produce self-induced vibration. With the help of a differential equation, the condition for unstability in metal cutting is established. This was experimentally verified with the help of specially built vibrational systems. Quite similar to the damping factor, a self-induced factor was introduced. The critical point of metal cutting stability was obtained when the self-induced factor was equal to the damping factor of the system.

Ceramic Tools

Dr. Ing. J. C. Das

Non-member

Ceramic tools are practically unknown in Indian metal cutting shops, but in industrially developed countreis of the world, these tools have been tested and found to be suitable for machining cast iron and steel. Suitably clamped in tool holders, these tools have higher ranges of cutting speed than carbide tools, but require comparatively rigid and heavy duty high speed machine tools for their efficient operation. Whether they will be able to replace carbide tools in the field of tool making will be decided in future, but they have already found a wide field of application in metal cutting shops.

Machine Tool Rigidity and Its Measurment

A. K. De

Non-member

The dimensional and surface quality of a work piece, the tool life and the production rate are very often influenced by the dynamic disturbances taking place in the machine tool. The modes of vibration, the corresponding natural frequencies, and the damping characteristic for the particular mode of vibration determine the dynamic behaviour of a machine tool under given disturbing conditions. All these values can be included under the term 'dynamic rigidity' of a machine tool. This paper deals mainly with the static rigidity of a machine tool and its measurements.

Planning for a New Machine Tool Undertaking

A. K. Ghosh

Associate Member

The important role which the machine tool industry can play in the industrial growth of the country is now generally recognized. In the establishment of new undertakings, a planned and thoughtful approach is, necessary and several aspects have to keft in view. The paper stresess that rationalization of manufacturing programmes is essential to obtain quality and quantity production of machine tool in India.

Economic Use of Metal Cutting Data

Prof. C. A. Gilpin

Non-member

An attempt is made in this paper to show how research results may be used in production applications. Metal cutting research has made available vast quantities of useful data that can be used for planning manufacturing operations to obtain maximum production at minimum cost. Most manufacturing companies establish their own standards for administration, engineering and operations. Many of the operation standards are concerned primarily with the non-productive procedures of an operation with less attention directed towards the metal cutting phase. This was probably due to the metal cutting procedures that were established from the knowledge gained by practical experience on the part of the process engineer. It seems natural that progressive process engineers would establish metal cutting standards based on the research data available for all the key metal cutting operations in their plants. When this is done, their reward will be maximum production at minimum cost.

Zone of Plastic Deformation in Metal Cutting

S. L. Gogia

Non-member

The classical theory of metal cutting explains that cutting process takes place by simple shear in a shear plane extending from the tool edge to the outer free surface of the work piece. On the assumption of this shear plane theory, many other theories have been evolved, but it is found that the agreement between these and the practical results is poor. Recently, it has been suggested that there exists a zone of plastic deformation of finite width, as against the assumption of the zone of plastic deformation of infinite width as suggested in the shear plane theory. It is shown that the size and shape of this zone affects the mechanics of metal cutting and also varies with cutting speed.

Adhesion and Diffusion Wear in Metal Cutting

Prof. T. N. Loladze

Non-member

Assessment of tool wear and study of tool failure are two important problems of metal cutting. It is essential the conditions existing in the contact zone of the tool and the worpiece are understood, and it is only then that it is possible to suggest suitable working conditions and enable metallurgists to develop new metallic alloys which have better wear resistance.

Depending on whether the stress at the cutting edge exceeds the ultimate stress or the flow stress, brittle or plastic failure takes place. This paper outlines the conditions for tool wear without considering tool shape deformation and brittle failure.

Cutting Performance of Controlled-Contact Cutting Tools

Prof. K. G. Trigger

Non-member

and

A. Bhattacharyya

Associate Member

Tests and investigational results are reported in this paper in a study conducted to explore the cutting performance of controlled-contact cutting tools. Research has demonstrated that properly restricted contact length has an important role in the cutting performance of these tools.

MINING AND METALLURGY DIVISION

Oil Exploration in India—an Evaluation of Surface Evidence

S. S. Sarwal

Member

Scientific development in recent years has rapidly advanced the oil exploration technique by providing aids for probing the earth, to locate underground rock structures and faults with greater accuracy. But despite this, the search for oil continues to be a highly speculative venture, because geological and geophysical procedures are indirect methods of investigation which seek only to locate structures favourable for the formation or accumulation of oil and leave the actual determination of the presence or absence of oil underground to the drill. Thus, while avoiding any judgment on the merits or de-merits of this method of investigation, it would not be out of place to stress the need for a more direct and economical method of surface investigation for verification of geological and geophysical data, if the odds against the successful finding of oil are to be further reduced.

Evaluating a technique for surface investigation, the author surveyed the important sedimentary basins in the country, geologically considered favourable for the formation of oil. The survey covered an area of nearly 155,000 sq. miles and as a result of this survey, it has been possible to systematically narrow down this vast area to about 6,000 sq. miles of sedimentary basins with promising oil bearing formations.

INSTITUTION NOTICES

The Institution's Contribution in the National Emergency

A Special Meeting of the Council was held in New Delhi on 13th November, 1962, to consider how the Institution could contribute to the national effort in the present emergency caused by the Chinese invasion.

The following decisions were taken by the Council:

1. The Council of the Institution wishes, on behalf of its members, to place the technical resources and knowledge of the Institution at the disposal of the Government of India, and to assure the Government of their fullest support and loyalty in the present emergency.
2. The Council of the Institution *resolves* that the President constitute forthwith an Institution Defence Fund and issue an immediate appeal to all its members to contribute generously to the Fund.
3. The Council of the Institution further *resolves* that the President communicate the texts of Resolutions 1 and 2 above of the Council to the Prime Minister of India.
4. The Council of the Institution *resolves* that, as the collections of contributions from members to the Institution Defence Fund would necessarily take time, the Institution should advance a sum of Rs. 1,00,000 to the National Defence Fund.

The Council also discussed other matters arising out of the above resolutions and from the present situation. It was agreed that the following should be done:

1. The date of 1st January, 1963, should be indicated in the President's appeal as the last date by which contributions from members to the Institution Defence Fund should be received at the Headquarters.
2. The Chairmen of the Local Centres should convey to their Local Centre Committees the wish of the Council that the Annual General Meetings of the Local Centres should be conducted without ostentation, and should generally confine to technical matters.
3. The 43rd Annual Convention of the Institution should be held in Bangalore in February, 1963, as planned, but it should be conducted on an austerity basis. The outstation tours after the Convention should be deleted. The Convention should be limited, as far as practicable, to technical matters. It was also agreed that the programme of the Annual Convention should be further reviewed at the next ordinary meeting of the Council.
4. The normal activities of the Institution should continue, including activities at the Local Centres, but in a manner that would avoid any wasteful expenditure.

The Institution's Donation to the National Defence Fund

A letter was addressed by Maj.-Gen. Harkirat Singh, President, to the Prime Minister of India, offering the Institution's contribution to the national effort in this present emergency. The text of the letter is reproduced below.

'The Council of the Institution of Engineers (India) of which I have the honour to be the President, held a Special Meeting in New Delhi yesterday to consider in what manner the Institution could make contribution to the national effort in the present emergency.

In the unanimous desire to place the technical resources and knowledge of the Institution at the disposal of the Government of India, the Council adopted the following resolutions which they have asked me to communicate to you.

(i) The Council of the Institution wishes, on behalf of all its members, to place the technical resources and knowledge of the Institution at the disposal of the Government of India, and to assure the Government of their fullest support and loyalty in the present emergency.

(ii) The Council of the Institution resolves that the President constitute forthwith an Institution Defence Fund and issue an immediate appeal to all its members to contribute generously to the Fund.

As the collection of the contributions within the Institution Defence Fund will necessarily take a little time, the Council voted a sum of rupees one lakh from the funds of the Institution to be paid immediately into the National Defence Fund, and I have much pleasure in enclosing a cheque for this amount herewith.'

Proposed Upgrading of the Public Health Engineering Group to the Status of a Division

The Council at its 425th Meeting held on May 20, 1962,

'*Resolved* that the President be authorized to raise the Public Health Engineering Group to the status of a Division as and when satisfied that the number of Corporate Members in that Group had reached the number of 500.'

Attachment to this Division, if formed, will be open to Corporate Members and Graduates of the Institution (Students are not classified) who are qualified and practising in the field of public health engineering and are generally classified at present under the Civil Engineering Division in the Year-Book 1960-61 issued by the Institution, or in their letters of election of attachment in the case of those subsequently elected or attached.

The classification of each Corporate Member and Graduate as given in the Year-Book or the letters of election or attachment is based on the information made available by the member himself in his original application form and the Membership Allotment Form previously attached to the March 1961 *Bulletin*. As a consequence of the above resolution of the Council, in order to assess correctly the strength of members who support the propsed upgrading of the Public Health Engineering Group to the status of a Division, a census is now being taken through the card attached to this *Bulletin*.

As this is the only satisfactory means of ascertaining the true and representative strength of members desirous of being attached to this proposed Division, you are requested to return the card, complete in all respect not later than **January 10, 1963.**

43rd Annual Convention, Bangalore, February 1963

At a Special Meeting of the Council held in New Delhi on 13th November, 1962, to consider how the Institution could contribute to the national effort in the present emergency, the Council decided that the 43rd Annual Convention in Bangalore in February 1963 should be conducted on austere lines. It was also decided that all the outstation tours proposed after the conclusion of the Convention should not take place in order not to bring added pressure, on the transport systems. The programme of the Convention will receive the further attention of the Council at their next meeting to be held in Calcutta on 9th December, 1962.

Change of Honorary Secretary, Assam Centre

Shri B. D. Sarma, (*A.M.*), Honorary Secretary, Assam Centre, having been transferred from Shillong, Shri S. C. Dey (*A.M.*) was selected by the Committee of the Local Centre on September 5, 1962, to take over the office of the Honorary Secretary for the interim period till the next Annual General Meeting of the Centre. Shri Dey has taken over charge from October 23, 1962.

Refresher Course on 'Design of Shell Structures', Indian Institute of Technology, Kharagpur, May 15-25, 1963

A short refresher course on Design of Shell Structures will be held in the Civil Engineering Department, Indian Institute of Technology, Kharagpur, from May 15-25, 1963. The course has been designed for the benefit of practising engineers and teachers in engineering institutions, to make them conversant with the present developments in the field. Further details regarding the course can be had from Dr. S. K. Mallick, General Organizer, Short Course on Shell Structures, Civil Engineering Department, Indian Institute of Technology, Kharagpur. The last date for receiving applications is January 15, 1963.

FORTHCOMING CONFERENCES

Seminar on 'Power and Industrial Alcohol Industry', New Delhi, 1963

A Seminar on 'Power and Industrial Alcohol Industry' will be held in New Delhi during 1963, to discuss new developments of chemical industries relating to ethyl alcohol, its by-products and wastes. The membership fee for the Seminar is Rs. 500 and papers are invited on the following subjects : (1) Economy of energy means—fuel, steam, cooling water and power; (2) Design, construction and intensification equipment for production of ethyl alcohol and its by-products; (3) Automation and instrumentation; and (4) Industrial utilization of alcohol, and its by-products and wastes. Further details of the Seminar can be obtained from the Secretary, All-India Distillers' Association, H-37 Connaught Circus, New Delhi 1.

27th Annual Session of the Indian Roads Congress, Chandigarh, December 1962

In view of the present National Emergency, the Executive Committee of the Indian Roads Congress have decided not to hold the 27th Annual Session of the Congress at Chandigarh from December 5 to 12, 1962.

Symposia on 'SewageTreatment' and 'Public Health Engineering Education', Nagpur, December 1962

In view of the National Emergency, the symposia on Sewage Treatment and Public Health Engineering Education which were scheduled to be held under the joint sponsorship of the Central Public Health Engineering Research Institute, Nagpur, and the Public Health Engineering Group of the Institution of Engineers (India), and the Nagpur Branch of the Institution, on December 26-27, 1962, have been postponed.

Conference of Automation and Computation Scientists in India, Sindri, February 22-24, 1963

It has been tentatively decided to hold a Conference of Automation and Computation Scientists in India in February 22-24, 1963, at the Bihar Institute of Technology, Sindri, Bihar. The Conference will be held under the auspices of the Institution of Engineers (India), the representative in India of the International Federation of Automatic Control. It is intended to lay a foundation for exchange of information between the scattered units or workers in our country in the field of automation and computation. Mutual contacts and appreciation of work that are being carried out in the various avenues of the vast field encompassed by automation and computation are expected to lead to the development and understanding of this very important branch of science and technology, which is comparatively of recent origin in our country. Papers and discussions on the following topics from potential participants are most welcome. Automatic control: (i) Theory of automatic control systems—System analysis; (ii) Design of automatic control systems—System synthesis; (iii) Technical problems of automatic systems; (iv) Components of control systems; and (v) Advanced problems on automation (analysis of periodic and aperiodic signals with particular reference to the response to such signals of linear and non-linear networks, stationary as well as time-varying; linear smoothing and filtering; information theory; sampled data linear and non-linear systems for statistical processes; multi-input systems; sequential control systems; adaptive systems). Automatic computation: (i) Digital computers; (ii) Analogue and other special purpose computers; (iii) Data processing and programming; and (iv) Numerical methods and operational Research (with particular reference to modern electronic computers).

Those interested in participation may please contact Dr. Tribhuan Prasad, Convenor, Conference of Automation and Computation Scientists in India, Bihar Institute of Technology, P.O. Sindri Institute, Dhanbad, Bihar.

A nominal registration fee of Rs. 5 will be charged. A tentative programme and other information will be communicated on request made directly at the above address.

The names and addresses of the individuals who intend to participate must reach the above address by December 31, 1962.

International Welding Exhibition, Olympia, London, April 23-May 2, 1963

The International Welding Exhibition will take place in the National Hall of Olympia, London, from April 23 to May 2, 1963, throughout the course of the London International Engineering Exhibition (which will occupy both Earls Court and Olympia simultaneously). The exhibition is sponsored by the London Chamber of Commerce and organized jointly by F. W. Bridges and Sons, Ltd., and Industrial and Trade Fairs, Ltd. Further details may be had from the International Welding Exhibition, 641, Grand Buildings, Trafalgar Square, London, W.C. 2.

Conference on the Design and Use of Microwave Valves, London, September 1963

The Electronics Division of the Institution of Electrical Engineers is organizing a Conference on the Design and Use of Microwave Valves which will take place in September 1963. This has been timed to fall in a year between biennial international conferences in the microwave valve field, and the programme is planned to be complementary to these conferences. The aims of the three day national conference are to review the present techniques and developments. The following will be among the subjects to be covered; (i) Signal amplification and physical measurement, (ii) Communications and industrial applications, and (iii) Radar. Among the applications to be covered are: radio astronomy, plasma physics microwave links, C.W. radar, F.M. radar, pulse radar, and heating. The discussion on valves will include: travelling wave tubes, klystrons, backwave oscillators and amplifiers, magnetrons, modulators, duplexers, and gas lasers. The aspects to be covered include fundamental valve design, present performance and the use of valves in systems, including the matching of desired system parameters with achievable valve performance.

Further details may be had from the Secretary, The Institution of Electrical Engineers, Savoy Place, London, W.C.2.

BOOK ACKNOWLEDGMENTS

1. **Road Engineering.** V. B. Priyani. *Charotar Book Stall,* Anand, 4th edition. Rs. 8. 324 pages.

This amply illustrated book for students on the fundamental principles of road engineering also covers air ports, earthwork, and road bridges which form the component parts of modern road engineering.

2. **Machine Design Data Handbook.** B. R. Narayana Iyengar and K. Lingaiah. *Engineering College Cooperative Society, Bangalore,* 1st edition, 319 pages.

Gathered from various sources and made readily available, the book contains several useful tables, design charts, formulae, graphs, etc., all of which have been carefully selected and classified in the form in which they are required in actual working.

3. **Properties Processes and Uses of Engineering Materials.** V. D. Sahasrabuddhe. *Anath Vidyarthi Griha Prakashan,* Poona, Rs. 8. 268 pages.

This text-book is designed to meet the needs of the students in the first year diploma or degree course. A feature of this book is the glossary attached at the end of each chapter.

4. **Line Telegraphy.** P. N. Das. *Model Book Agency Private Ltd.,* Calcutta, Rs. 7.50. 179 pages.

This book is meant for the undergraduate students of telecommunication and electrical engineering. Questions and examples have been provided at the end of each chapter.

5. **Higher Surveying.** Vol. 2. C. B. Breed and G. L. Hosmer. *John Wiley & Sons, Inc.,* New York, 541 pages.

Chiefly devoted to a consideration of the various methods of conducting topographic and hydrographic surveys, the eighth edition of the second volume of this work is, in essence, completely rewritten. Observational methods have been modernized, and all data have been brought up to date as far as possible. A new section has been added on electronic surveying. Applications of photogrammetry is a new chapter covering choice of survey methods, air-photo interpretation, specifications for aerial surveys, production of aerial survey products, and applications of aerial survey products to highway engineering, city planning and special projects. A revision and updating of aerial surveying and stereo-photogrammetry has also been done. Chapters on hydrographic surveying, measurement of flow of water in open channels, map projections, horizontal control, vertical control, astronomical observations have been revised. Error analysis is a new chapter comprising valuable discussion on treatment of various kinds of errors and their propagation.

6, **Earth and Rockfill Dam Engineering.** G. F. Sowers and H. L. Sally. *Asia Publishing House,* Bombay, Rs. 20. 283 pages.

This text-book comprises recent advances in soil mechanics and mechanization of construction. Scientific principles as well as the art of design and construction of dams from easily available earth and rock are discussed. The book contains an extensive list of references and a comprehensive index.

7. **Metallurgical Principles for Engineers.** J. G. Tweeddale. *Iliffe Books Ltd.,* London, 85s. 560 pages.

The book explains the relationship between metal physics and the practical use of metals, and discusses the development of specific properties in alloys to meet engineering requirements. It also covers such aspects of metallurgy as the crystalline state and its control, the 'tools' of the metallurgist, principles of costing, mechanical working, welding, heat treatment and powder metallurgy. In addition it deals exhaustively on service problems and conditions, including the effect of high stresses and temperature, corrosion, creep fatigue, notch sensitivity, radiation damage and wear. Consideration is also given to the influence of extraction methods on costs. An extra feature is the glossary of metallurgical terms. Written for engineers and for professional metallurgists, the book may also be found useful by students.

CORRIGENDUM

TO VOL. 12, NO. 2, OCTOBER 1962

Page 89, line 13 : instead of '1956', please read '1946'; and line 15, instead of '1941', please read '1921'.

EMPLOYMENT SERVICE

This service is intended for the benefit of members of the Institution and for the Government, industrial and other organizations employing engineers. It is hoped that the employers will make full use of this service to obtain their requirement.

A small charge of Rs. 5 per insertion will be made to members for notices appearing in the 'Situations Wanted' column.

In the 'Situations Vacant' column a charge of Rs. 2 per line will be made.

Replies to advertisements should be addressed to Employment Service, The Institution of Engineers (India), P. O. Box No. 669, Calcutta 20, except where otherwise stated.

THE BULLETIN
OF
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SECRETARY & EDITOR: B. SESHADRI, B.Sc., A.I.I.Sc., D.I.C., M.Sc.(Eng.), M.I.E.

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A BRIEF REPORT ON THE FOURTH INTERNATIONAL CONGRESS ON PRESTRESSED CONCRETE, ROME, MAY-JUNE 1962

K. F. Antia
Member

Introduction

The International Federation on Prestressed Concrete, of which India is a member, holds a congress every four years. The Fourth Congress was held in May-June 1962, at Rome and at Naples. The deliberations were followed by a study tour. Nearly 1,200 delegates attended from 47 countries. Four engineers attended from India, including two official delegates, Sarvashri S. L. Bazaz and K. F. Antia.

The extraordinary strides which have taken place in prestressed concrete within recent years were highlighted through the following six themes :

.1 Results of research with special reference to durability and fatigue ;

.2 Site considerations (problems and difficulties), remedies and solutions ;

.3 Economics of prestressed concrete in relation to regulations, safety, partial prestressing, light-weight concrete, etc. ;

.4 Progress in precast factory manufacture and standardization ;

.5 Outstanding structures in prestressed concrete construction :

  .5.1 Bridges, viaducts and elevated roads

  .5.2 Buildings and other structures ; and

.6 Prestressed concrete roads.

A resumé of the developments in prestressed concrete as brought out at this Congress is given below.

Site considerations (problems and difficulties), remedies and solutions

1. Joints in precast prestressed concrete construction : Joints are now formed generally in the following five ways :

.1 Joints with concrete cast *in situ* : Such joints are made about 3 in. wide which is the minimum width for good compaction, and although they are generally satisfactory, their shortcomings are the need of formwork and the time required for maturity ;

.2 Wet cement-sand mortar for small sections and light units : Possibilities of overcoming the shortcomings of such a joint, *viz.*, lack of control over finished thickness, low early strength and uncertainty of the area of contact, are available by prestressing the two members together as a method of erection and of ensuring full bearing on the joint while it is still plastic ;

.3 Earth-dry mortar joint : The suitable size of this joint varies from ¾ in to 1½ in. and arrangements have to be provided for caulking the joint thoroughly. Electric hammers have been successfully used but the gap required in this varies from 1½ in. to 2 in. A rich mortar is used with a water-cement ratio of 0.2;

.4 Dry joints: Joints without any mortar require a high degree of accuracy in the contact surfaces at the joint;

.5 Epoxy and thermoplastic polyester resin joints: Such joints are made about ¼ in. wide. Experiments are in hand to ascertain the tensile characteristics of prefabricated units joined with these resins.

2. Formation of tendon ducts: The formation of tendon ducts presents difficulties in that they may not be of a uniform diameter, true to profile, grout-tight, exactly located and with a low friction value.

Inflatable rubber tubes are difficult to keep in position as they float in wet concrete (the tubes are filled with water to reduce this tendency) and have to be held with wire ties at close intervals. Moreover, the friction of the cables is high in such ducts.

The wobble factor, *viz.*, the variation in alignment of the duct, is also high.

Light gauge metal sheathings are generally used in two forms, *viz.*, one with a corrugated profile and a continuous longitudinal welded seam and another having a convoluted profile with a continuous lapped helical seam. The corrugated type is more satisfactory but is difficult to use in sharp curves. The convoluted type is more flexible but is liable to permit grout to leak. Joints between adjoining sections of sheathing present difficulties through not being mortar-tight and there is always the danger of mortar from the concrete finding its way into the sheathing through accidental holing of the sheath by a vibrator.

No completely satisfactory method of providing continuity in the tendon ducts in prestressed concrete members built up with prefabricated units has so far been evolved. When inflatable rubber tubes are used, the section of the duct is some times found to reduce at the joint. When metal sleeves are used, grout is some times found to penetrate the duct. The procedure adopted in such construction is, therefore, to defer the grouting until all the cables are stressed.

3. Threading and tensioning of tendons through ducts: Difficulties are experienced in threading larger tendons such as a 12-wire cable presumably because of sharp curvature, discontinuity at joints, leakage of mortar and damage to the sheath. Although a simple remedy lies in the adoption of sheaths of larger diameter, the cost of grouting in such cases increases and it may not be possible to accommodate larger sheaths at a congested section.

The introduction of prestressing bars into ducts after the hardening of concrete is some times found to be difficult because of the stiffness of the bar or the sharpness of the curves of the ducts.

4. Friction of tendons and ducts: It has been found that friction of tendons is reduced by 'see-saw' stressing which consists of incresing the tension at opposite ends by increments.

5. Stressing: Double-end stressing is desirable with cables of sharp curvature or large total angle change, but undesirable with flat curves due to slip because of trans-

mission of shocks along the cable from one end to the other as frictional forces are overcome.

6. Strands as tendons: Strands of large diameters have been developed for tendons but the following difficulties are experienced with them:

.1 Threading of the strands into ducts becomes difficult because of the 'banana' effect at the end and a solution has yet to be found;

.2 Strands cannot be cut like wires and the only method of cutting them behind the anchor is with an oxy-acetylene flame which cannot be brought too close to the anchor;

.3 Frictional loss is difficult of determination because of the nonlinear relation between stress and strain;

.4 The strand has a tendency to unstrand at the free end. This difficulty can be overcome by using circlips, by welding or by binding; and

.5 There is coreslip because of lack of grip between the several layers of wire in the strand.

7. Stress transfer: Stress transfer in pre-tensioned work is the most critical time for the member and if the procedure involves further extension of tendons before packs can be removed and load released, the additional tension on the member can cause cracking.

8. Grouting: Inadequacy of grouting may be due to air being entrapped or due to water preventing complete filling of the duct, or, because of shrinkage and segregation of grout.

To prevent blockages during injection, the precautions necessary are that the consistency of the grout must be strictly controlled and colloidal suspension must be obtained; the grout reservoir should be separate from the mixing chamber; the grout should be agitated and its level kept continuously above the outlet; dry materials should be sieved and mixed grout filtered; all the equipment should be kept scrupulously clean and injection into any one duct should be continuous.

Attention to details in grouting is of greater importance than the introduction of plasticisers and expanding agents.

9. Failure of tendons and of anchorages: The very few failures that have been found in tendons have been with high tensile steel bars and they have been due to the anchor plates not having been set at 90° to the axis of the bar. It has also been ascertained that with the rolled-on thread now in common use with bars an angle up to 8° between the nut and the anchor plate is possible without undue risk of failure.

Slips in conical wedge anchors have occurred when the serrations of the grips have become choked as the wire is drawn through the anchorage during stressing. This is likely to occur when there is too much scale on the wire and therefore, the surface condition of the wire is important.

10. Condition of high tensile steel wire with ageing: A check carried out in Czechoslovakia on high tensile steel wire and cement grout indicates that there was no

damage to the wire in prestressed concrete structures built ten years ago in spite of the grout not being always good.

11. Corrosion : The quality of concrete is as important as the thickness of the cover to prevent corrosion.

A metal kept in a damp unventilated space is found to corrode more quickly than a metal kept in a ventilated space.

No corrosion in high tensile steel has so far been attributed to electrolytic action. Information gathered indicates that it is advisable not to have copper near prestressing wires. It is also necessary to keep chlorides away from the wire that is being stressed and any additives to the concrete should be carefully tested to ascertain their effect on the high tensile steel wire before they are used.

Some investigations indicate that the incidence of stress corrosion, *viz.*, more rapid corrosion of steel under stress, is connected partly with the structural composition of steel. Bainite, a higher form of martensite, is apparently susceptible to stress corrosion cracking.

12. Difficulties with high early strength cement : Production of high early strength cement generally through finer grinding is on the increase in certain countries such as New Zealand because of precast product manufacturers' demand for early release of moulds. Such cement has raised problems of shrinkage, early stiffening and reduced workability. Also later strengths have been found not to be much greater than early strengths.

13. Prefabricated construction for bridges : In some countries such as New Zealand, prestressed concrete bridges are mostly of the prefabricated type. Steel form or forms lined with steel are insisted upon.

Economics of prestressed concrete in relation to regulations, safety, partial prestressing and light weight concrete

1. Prestressed concrete is considered the most challenging new structural material for structures and bridges that has been introduced since the adoption of structural steel.

2. In the U.S.A. alone, the turnover of the prestressed concrete industry aggregated to 200 million dollars in 1960.

3. Prestressed concrete has now come to be regarded as the general medium of construction for small and medium size road bridges. Large size road bridges with spans up to 500 ft. are also being constructed in prestressed concrete. It has been proved in more than one country that the cost of a prestressd concrete bridge is substantially less than that of a bridge in other materials for the same span and loading, even with spans up to 500 ft.

4. Economical design in prestressed concrete structures may be obtained either by rationalizing the design or by using light weight materials. In the U.K. and Japan, partial prestressing has been adopted in many small span bridges. With the adoption of partial prestressing, the initial prestressing force and the number of tendons can be reduced by about 10%, and as a result of this, a saving of about 3% has been obtained in Japan without any lowering of load factors.

The reduction of dead loads through the use of light weight materials is being considered in many countries. It is, however, of particular significance in Japan because of the relatively poor ground conditions and liability of seismic tremors.

5. In the preparation of codes for prestressed concrete, two sets of different conditions have to be dealt with—one for buildings and another for bridges. For example, the ratio of live load to dead load is higher in bridges than in buildings and is also subject to more frequent changes in bridges, and the question of fatigue has to be given serious consideration. Similarly, exposure hazards for bridges are greater than for buildings. Hence, two sets of clauses are necessary to cover many requirements.

6. It has been established in Japan that for resisting sesmic tremors statistically determinate frames together with a combination of prestressed concrete and other types of construction result in an economical design.

Progress in precast fatory manufacture and standardization

1. Considerable advances have been made in precast factory manufacture in various countries. For example, in the U.S.A., there were 200 precasting plants in 1959 with an output of 1.2 million c.yd. In Japan, there were 50 precasting plants in 1960 with an output of 0.11 million m.^{3} and 46% of all the prestressing wire was used in these plants. In the same country, 1.3 million prestressed concrete railway sleepers existed in the tracks in 1960 and their annual output is 0.4 million sleepers.

2. In the U.K., sections have been standardized by most manufacturers for piles, beams and floor units. In the case of small bridges, inverted T-units have been standardized to act monolithically with cast *in situ* concrete. In one case, for road bridges, standard beams consist of 7.6 to 16.7 m. and are designed to sustain cast *in situ* concrete and construction traffic. The design loads are taken by the composite section after concrete is placed *in situ*. Three beams are provided to cover 1.5 m. width of bridge.

3. Prestressed concrete beams have been standardized in Poland for spans from 9 to 60 m. and a 3 m. module has been adopted. For spans from 9 to 15 m., the beams are I-shaped and prestressed. For spans from 15 to 24 m., the beams are hog-backed and made up of 1 to 4 units, prestressed together at site. For spans from 30 to 60 m., trusses with joists or channel members precast in units are joined together at site by prestressing. Even crane gantry beams of spans from 6 to 15 m. are cast in 3 m. lengths and connected at site by prestressing.

4. Industrial buildings are standardized in Rumania and bays 6 m.×12, 18 and 24 m. and also 12 m. × 18 and 24 m. are used with or without overhead transport of 1.5 to 3 tonnes capacity. Bays with gantry girders with capacity of 5 to 32 tonnes are used in bays of 6 or 12 m.×18, 24 and 30 m. Skylights are either vertical or of triangular shape.

5. Precasting of smaller units is done in factories in Holland and economy is effected through high strength concrete of 600 kg. per cm.^{2} Larger units are cast at site. The trend is now towards construction of isostatic structures rather than hyperstatic structures. The reasons are that the labour cost for hyperstatic structures is higher. The hyperstatic structure, contrary to general impression, is not more economical in materials; secondary stresses need careful investigation and extra steel has to be added at the joint.

For buildings, precasting (for isostatic structures) is on the increase whilst, for bridges, *in situ* work is preferred for spans up to 25 m. For spans beyond this range, the cost of falsework and shuttering makes prefabricated construction more economical.

6. Prestressed concrte sleepers in Czechoslovakia are of the post-tensioned type. Pre-tensioned sleepers are to be introduced from 1965 for reasons of economy. The pre-tensioned sleepers will be of two types, one in which the wires are anchored by bond and another in which wires are looped round cast iron anchorages.

7. The method of precasting beams of U-section has been introduced in Australia in which the sides and the top of the U-beam are formed by an extrusion head.

For steam curing, portable covers of fibreglass have been adopted, as this material is light, drapes easily round the product, has a low thermal conductivity and has excellent resistance to corrosion in high temperature and humid conditions.

Results of research with special reference to durability and fatigue

1. Transverse connections of bridge beams: A new method of connecting transversely individual beams of a prestressed concrete girder bridge has been tried with success in Czechoslovakia. The jointing consists of mild steel reinforcement protruding from the webs of the beams grouted in the longitudinal joints between the beams.

2. Composite construction: Research has been carried out in Japan on some aspects of composite construction with prestressed concrete units. The aspects considered are differential shrinkage, creep and bond between prestressed and *in situ* concrete and their static and fatigue failure strengths. The conclusions arrived at are:

.1 Flexural rigidity of a composite beam is generally less than that of the normal beam;

.2 The fatigue strength of a composite beam is probably about 60% of its strength under static load;

.3 The strength of an over-reinforced composite beam depends on the strength of the *in situ* concrete;

.4 The cracking moment of the composite beam is generally reduced from 0 to 20% of the normal prestressed beam;

.5 The ultimate strength of a composite beam can be calculated with sufficient accuracy; and

.6 Although good bond between prestressed and *in situ* concrete is obtained simply by roughening the jointing surface, it is preferable to have shear connectors.

Tests in the U.K. show that differential shrinkage in composite rectangular beams may be ignored, but the tensile strains in the *in situ* concrete are in the range of 4×10^{-4} to 6×10^{-4} before cracking occurred.

3. Crack detection: An equipment for detecting cracks as small as 0.001 mm. has been evolved in Czechoslovakia

4. Fire resistance of prestressed concrete : Research on the behaviour of prestressed concrete subject to fire shows that failure of a beam carrying the design load will occur when the temperature of the high tensile steel reaches about 400°C. If the temperature of high tensile steel exceeds 180°C., the prestressed concrete member needs strengthening or replacement.

5. High tensile steel strands : The bond characteristics of high tensile steel strands have been tested in Australia, as such strands are being increasingly used. The conclusion is that the bond stress is similar to that for plain round bars.

Information on transmission lengths of high tensile steel strands in pre-tensioned members which was lacking has been determined in the U.K. and has been found to be between 11 and 14 in. for 0.5 in. strands and between 18 and 22 in. for 0.7 in. strands.

Special anchors have been developed in Japan for strand cables and four varieties are now available. These are :

.1 Circular segmental wedges ;

.2 Anchors consisting of special shaped tubes with strands buried in highly compressed concrete ;

.3 Triangular pyramidal cones for three strands ; and

.4 A serrated cone system with a steel cylindrical pulling head.

6. Epoxy resin coating : The effect of coating high tensile steel bars with epoxy resin has been found in Australia to increase its bond at all ages. Concrete was placed within one hour of coating of the bars and the concrete and resin therefore hardened in contact with each other.

7. Prestressed concrete railway sleepers : Research in Japan on prestressed concrete railway sleepers indicates that :

.1 The pressure of the rail on the sleepers may be taken as 0.88 of the wheel load on the rail ;

.2 The recess in the middle of the underside of the sleeper is very effective in reducing the ballast reaction there ;

.3 Testing of prestressed concrete sleepers consists of ascertaining the flexural strength of the section under the rail and also that in the middle of the sleeper. A factor of safety of 2 to 3 against cracking and 3 to 4 against flexural failure is provided for ; and

.4 Prestressed concrete sleepers stand up very well to fatigue loading.

8. Joints in post tensioned beams : Research in Japan on the effects of joints in post-tensioned beams of precast units has brought out the following points :

.1 The time lapse since the making of the joint and the width of the joint does not effect the behaviour of the beam ;

.2 The cracking load of the joint is 10% less than in the precast unit ;

.3 There is no decrease in the ultimate strength of the beam as long as the strength of the joint is not less than 85% of that of the precast unit ;

.4 Some decrease has been found in the diagonal cracking load in beams with joints ; and

.5 The tensile strength of the joint is about 40% of the tensile strength of the concrete in the joint.

Tendons : There was a suspicion that the fatigue strength of beams was reduced if curved tendons were present, as the change in the direction of the steel at a bend was considered to cause a stress raiser. Tests have proved the fallacy of this suspicion.

10. End blocks : Tests in the U.S.A. have also brought out the fact that omission of end blocks in pre-tensioned beams does not have an adverse effect on the fatigue behaviour of the beam and end blocks are therefore not necessary in pre-tensioned members.

Investigations in the U.K. are in hand on :

.1 Stress distribution in end blocks of post-tensioned beams ; and

.2 The behaviour of prestressed concrete beams of various sections subject to combined bending and torsion.

11. Deflection : A comparison of the calculated values of deflection of pretensioned beams with tests shows that discrepancies increase .1 with increase in the number of wires when nearing ultimate loads, .2 because of nonlinearity in the stress-strain curve, and .3 due to inaccurate assessment of loss in prestress and of modulus of rupture.

12. Development pertaining to designs :

.1 By measuring the strains and applying the stress-strain diagram, satisfactory values of stresses, deformation and ultimate loads with prestressed concrete members have been determined in the U.A.R. ;

.2 Simple methods similar to those used for reinforced concrete have been developed in the U.A.R. for determining the dimensions of prestressed concrete sections and the stresses and ultimate strength in these ;

.3 Investigations in Poland have been carried out for the determination of the actual bending moment distribution in prestressed continuous structures beyond the elastic limit ;

.4 Investigations were also carried out on the influence of time on the dynamic characteristics of prestressed concrete railway bridges. One of the results of investigation is that the increase of concrete hardness produced by the working load and the increase of strength in the course of time influence the rigidity of the structure and therefore its dynamic properties ;

.5 Stress-strain diagrams corresponding to different numbers of loading cycles in repeated loadings have been established in Czechoslovakia. In addition, the effect of repeated loading on the bond between tendons and concrete has been determined ; and

6 A new method of calculation of ultimate strength based on the theory of limit strains has been established in Czechoslovakia.

COMMUNITY DEVELOPMENT—THE STORY OF A VILLAGE REBUILT

J. Datt
Member

This is a simple story of how concerted voluntary effort and a spirit of self-help transformed one village from a primitive, backward state to a place of good and clean living with material prosperity. It is the story of the evolution of the Community Development Programme, a very important facet of our Five Year Plans

It is, too, a story of how technical skill put freely at the disposal of the villagers, who had no knowledge of how to transform their desires into achievement, played a decisive part in making the ultimate success possible. It proved that, in the present Indian conditions, cooperative effort alone would make it possible for village uplift schemes to attain fruition.

The Community Project, as conceived by the Government, was designed to promote the pre-requisites for additional productivity such as can cater for all the basic elements of rural life. The outline note on the Community Project issued by the Government of India said, 'The purpose of the Community Project shall be to serve as a pilot in the establishment, for the men, women and children covered by the project area, of the 'right to live', food, the principal item in the wherewithal for this purpose, receiving the primary emphasis in the initial stages of the programme.'

The question may be asked, why development in the rural areas only. Eighty-two percent of India's population live in villages. Our villages, therefore, form the backbone of the country, and any attempt made to improve the living conditions of the villagers, it follows, will be a practical contribution to the national advancement.

But the task of improving the villages poses a formidable problem. Although there can be no panacea for all the ills which exist in varying degrees and forms—the most serious among which are unemployment, lack of medical help, illiteracy, fragmentation of land, indebtedness, poor crops yield, insanitation, litigation, and lack of communication lines and irrigation facilities—yet, with some voluntary cooperative effort and right guidance, most of these ills can be remedied.

It was, therefore, that the activities which had top priority in the Community Project Programme were agriculture, improvement of communications, education, health, vocational training, employment, housing and social welfare. The list is formidable both in scope and magnitude. No Government agency, howsoever extensive, can implement such a programme on its own. It is patent that the villagers need aid for agriculture including modern scientific techniques, communication for marketing of the produce, education facilities both for children and adults, health facilities (curative as well as preventive), training both vocational and technical, facilities for employment of the unemployed and the under-employed, improvement of housing, and other measures for social welfare.

Government agencies with available financial resources can provide for the essential items of development which primarily concern the community as a whole. That means the effort shall have to be supported by the village people with their own contribution either in cash or with voluntary labour.

It follows, therefore, that a substantial part of the development necessary falls on the shoulders of the villagers themselves. Their effort will be complemented by Governmental effort, which will provide, in every phase of activity and at every stage of the programme, the technical knowhow.

After the considerable association the author had with the Community Development Programme, he is convinced that the success of the Programme will depend to a very great degree on two factors: (i) the extent to which the spirit of self-help and self-reliance of the villagers can be brought to bear on the individual programme; and (ii) the extent to which the technical staff associated with an individual programme identify themselves with the villagers and win the confidence of the people with whom they are working.

The engineer is in a privileged position to offer the fruits of his education and training, in the college and after, to such village uplift schemes, and the experience which he derives in his professional work provides him with the necessary background to organize the community on scientific lines. It must, however, be emphasized at the same time, that before he can use his skill and experience in the programme, he must possess a genuine aptitude and a feeling of service for this work. He should remember that the villagers are intelligent people, and if properly handled and guided, can achieve remarkable results.

The uplift of the small village of Nagwan in Bihar will serve to illustrate the foregoing thesis. Nagwan is one of the 70,000 villages in that State. It is 15 miles from Patna, has a population of about a thousand people, and there are 120 houses in it. When the full story of the Community Projects and village uplift is told one day in the distant future, the achievement of Nagwan will take a honoured place.

The first move came from the villagers themselves. They decided to improve their lot. They formed a Village Uplift Committee and began to raise funds for this purpose by levying a local tax of half an anna per rupee on the exports from the village. In a space of three years, they were able to collect Rs. 3,000. They, however, lacked the technical knowhow to put the money to good use.

Nagwan at that time presented a sorry picture. Even the lanes in the village were impossible to negotiate without the use of wooden planks. It was at this moment that the Rotary Club of Patna came to hear of the villagers' plight and their aspirations. It decided to adopt the village and provide the knowhow.

The first target for attack were the aforesaid lanes. The whole thing was transformed to something worthwhile in a short time. The approach road, main lanes and bye-lanes of the village were constructed in cement-concrete. The entire village was provided with *pucca* drains. The villagers provided voluntary and free labour and the author on behalf of the Rotary Club, the 'knowhow'. The task was made easy, and the financial difficulties were overcome. Nagwan is the only village in India today which is both electrified and has cement roads and lanes.

The next target was the water supply of the village, which was derived wholly from old wells. These were nothing more than holes dug into the earth. The surrounding ground was irregular, untended, and full of puddles Impurities constantly seeped into the wells, polluting the water and creating a health hazard. This state of affairs was remedied by the construction of a *pucca* parapet and a sloping concrete platform round the wells with a circular masonry channel round the platform. Two well-made bathrooms attached to the centrally located community well provided additional amenities to both the sexes. Sanitation was improved by connecting each house with the main drain and by providing precast ventilators where ventilation was inadequate. Disinfection with D.D.T. was introduced as a regular measure.

Next came agricultural improvement. To popularize the preparation of compost manure, a number of *pucca* manure pits were constructed to conserve useful fertilizer materials, which were being wholly wasted. Waste from the cattle sheds and mangers rich in nitrogen raised greatly the yield of crops, which registered a spectacular rise of 50%. Weed and insect control measures were introduced. Vegetable farms and fruit orchards were organized. The result of all this has been that, today, Nagwan is not only self-sufficient in foodgrains as wheat, rice and maize but also in other agricultural produce as potatoes, vegetables, cotton, tobacco and jaggery. What is more, it is able to export most of these items, and a small levy on such export brings to the village a net income of some Rs. 1,500 a year.

Care of the cattle, an important source of village wealth, also received attention. Several mangers were constructed with concrete platforms to eliminate fodder waste and drains to lead the waste products into the manure pits. The men were given free advice in the care of cattle and veterinary problems. A stud bull was presented to improve the stock.

Education received a high priority attention. Today, Nagwan claims 100% adult literacy, a splendid achievement. The old school building was completely renovated with concrete floors and plastered walls. A village reading room and a library were organized. A girls school was started. The addition of a cultural club and a radio were two pleasing features to village life. There is no discrimination of caste or creed in any of these endeavours. The Harijan colony was reconstructed and the families provided with *pucca* tenements.

There is a Cooperative Society which deals in all commodities of daily use to the villagers. Cooperative farming is being introduced as an experimental measure. The village is fully electrified. There is a Youth League and a Scout Brigade. There is the Nagwan *Gram Panchayat* vested with full powers by the Government. The electrification made possible the introduction of cottage industries as poultry farming, bee keeping, making of bamboo products, soap making, and others.

The latest addition to the village is a community hall, a fine building constructed at a cost of Rs. 25,000 without any contribution from outside other than technical knowhow. The villagers call it the 'Village Secretariat', and with pride.

What perhaps is Nagwan's greatest triumph is the fact that other villages in Bihar have started to emulate its example. It has had a stream of visitors both from India and abroad. The obvious contentment of the villagers made possible for all of them to take back a happy picture of coordinated effort directed to benefit an entire community. The story which is here told, it is hoped, will assist in spreading the news of how much can be achived in our villages with the right spirit.

Summaries of Papers Published in the Journal, vol. 43, no. 4, pts. EL 2 & GE 1 December 1962

ELECTRICAL ENGINEERING DIVISION

A Note on Torque Problem in Rotating Machines

C. V. Govinda Rao

Associate Member

The author has developed a simple unified approach to the torque problem in rotating electric machines. In the treatment of polyphase machines, the discussion tacitly assumed that there were m coils or phases both on the stator and the rotor so that the angular separation between any pair of adjacent phase coils on either member remained the same and the rth stator and rotor coils included between them a constant angle δ. This by no means is a necessary condition for a successful development of torque or smooth working of the machine. The purpose of this paper is to show that m coils forming m phases on the stator and n coils forming n phases on the rotor are just as good for a uniform torque development except for the trival case $m = n = 1$.

Impedance Method of Detection of Shorted Turns in Turbo-Generator Field Windings

D. R. Kohli

Non-member

It is shown that the power frequency impedance of the field windings of a turbo-generator falls considerably when even one of the turns is short-circuited. This fact has been used for the detection of shorted turns.

Experimental curves are drawn showing the variation in impedance drop for various positions of the short-circuit and for different numbers of short-circuited turns. The paper also gives an empirical formula for the prediction of A.C. impedance of field windings and the results obtained from this formula are compared with the measured values.

Modern Trends in Construction and Maintenance of Transmission Lines

S. S. Murthy

Associate Member

In view of the increased impetus that is being given to the power development programmes in our national plans and the large capital outlays involved, it is essential that our power transmission systems are designed, constructed and maintained most up-to-date so as to provide reliable and dependable supplies to consumers at economical rates. The design techniques and construction materials which have a bearing on the methods of construction and maintenance of transmission lines are discussed.

Protective Current Transformers

T. U. Patel

Non-member

There is often confusion between the use of measuring current transformers and protective current transformers. In this paper, an attempt is made to explain some of the fundamental differences between these two types of current transformers and throw some light on the fundamental principles of protective current transformers and their operation and construction, explaining how to specify such transformers.

GENERAL ENGINEERING DIVISION

Metric System in Surveying

J. K. Varshneya

Non-member

With the changeover to the metric system, some of the surveying instruments have also changed. This paper describes the metric surveying instruments, specifies the values of certain constants used in survey work, and lays down the scales for various types of maps.

INDUSTRIAL ENGINEERING GROUP

Performance Sampling Study of Long Cycle Repetitive Jobs

G. Stephenos

Non-member

and

N. K. Datta

Associate Member

Performance sampling technique is used in this study for determining (i) the effectiveness of a group of workers engaged in long cycle repetitive jobs, (ii) the variation of the effectiveness on hour and day basis, and (iii) a productivity index in the form of labour and machine utilization. The study carried out in an engineering industry at Calcutta reveals that the effective utilization of labour and machine is rather poor (30 to 40%), mainly due to lack of proper supervision and the failure of the existing incentive scheme to provide adequate motivation. The study also indicates the loss due to bad planning on the part of the management.

Personnel effectiveness plotted on hour and day basis does not show the expected trend of a saddle-back curve. This may be attributed to the workers' deliberate attempt to keep the production rate at a fixed level, very near to the expected level fixed by the company's previous study based on historical data. This study shows the possibility of utilizing the performance sampling technique as a productivity index for labour and machine utilization and as an inexpensive but powerful management tool for analyzing the activities of a group of workers and determining the work load and the future planning.

INSTITUTION NOTICES

Postponement of the 43rd Annual Convention
Bangalore, February, 1963

The 43rd Annual Convention of the Institution which was to be held in Bangalore between February 2 and 9, 1963, has been postponed to the last days of February and the early days of March 1963. New dates will be decided by the Council at a meeting which will be held late in January, 1963.

A public notification of the postponement has been made in the leading newspapers in the country, and Local Centres and Sub-Centres were informed immediately the decision to postpone the Convention was taken after a meeting of the President and the President-Elect in Calcutta.

The Notice of the 43rd Annual Convention which will be issued early in February will be accompanied by a text of important programme changes if there are any.

Cancellation of Rail Concession for 43rd Annual Convention

With reference to a letter addressed by the Institution to the Secretary, Railway Board, in connection with availability of railway concessions to members participating in the 43rd Annual Convention to be held in Bangalore on dates which will be fixed by the Council, a reply has been received the text of which is reproduced below for the information of members.

'With reference to your letter No. DG/183 (43) dated 3-12-1962, I am directed to state that the Railway Board have decided to withdraw a number of travelling concessions including the concession admissible to the persons attending the annual conferences of all India bodies of social, educational and cultural importance with effect from 1-1-1963 in view of the present emergency. In the circumstances, no concession will be admissible to the persons attending the Annual General Meeting of your Institution to be held in Bangalore in February 1963.'

Publications of the Institution of Electrical Engineers, London

The Council of the Institution of Electrical Engineers, London, have decided to effect changes in the presentation of the *Proceedings* which will come into force in January 1963. The *Journal* will be issued monthly as at present. The *Proceedings* will be issued monthly combining Parts A, B and C of the present *Proceedings* in one issue.

The Electronics Division papers from the main *Proceedings* will be reprinted as *Electronics Quarterly*; the Power Division papers will be reprinted as *Power Quarterly*; and the Science and General Division papers will be reprinted as *Science and General Quarterly*. These quarterly publications will be issued in March, June, September and December. The annual subscription rates for the *Journal* and the *Proceedings* will be as below:

Journal	.. £2.15.0
Proceedings	.. £10.0.0
Electronics Quarterly	.. £3.10.0
Power Quarterly	.. £3.10.0
Science and General Quarterly	.. £3.10.0

Members of this Institution are allowed a discount of 25% on the subscription rates given above.

Journal of the International Federation of Automatic Control

The International Federation of Automatic Control has proposed to publish a quarterly Journal the basic purpose being not to produce yet more new literature and papers on automatic control, but rather review and publish the best of the technical papers published in other journals throughout the world in the field of automatic control.

The Institution is a member Group of the Federation since its establishment in 1958.

Training Course in Soil Mechanics

A short training course in soil mechanics commencing May 1963 has been arranged in France for foreign technicians. Since a good knowledge of French is essential, a special audio-visual course, lasting from one to three months according to the candidate's command of the French language, may be arranged for him in France before his training period. The training is offered under the Technical Cooperation Agreement signed between France and India. For further details, interested candidates may directly contact the Trade Commissioner for France, 'Adelphi', Queen's Road, Bombay1.

Draft Indian Standard

The following draft Indian Standard has been issued recently.

Draft Amendment No. 1 to IS: 1852-1962 Rolling and Cutting Tolerances for Hot Rolled Steel Products.

Members may send their comments on the above draft amendment before February 21, 1963, to Shri G. C. Khanna (*M.*), Chief Engineer, Punjab P.W.D., B. & R. Branch, Patiala, who is the Institution representative on the Sectional Committee dealing with this draft amendment.

Copies of the draft Standard may be obtained from the office of the Indian Standards Institution, 9 Mathura Road, New Delhi; or from its branch offices at 232 Dr. Dadabhoy Naoroji Road, Bombay; 11 Sooterkin Street, 3rd Floor, Calcutta 13; 2/21 First Line Beach, Madras 1; or 14/69 Civil Lines, Kanpur.

New Licences for Indian Standards Institution Certification Mark

The following licences have recently been issued by the Indian Standards Institution for the use of the Indian Standards Institution certification mark.

1. A licence has been issued to Basant Pran & Co., Howrah, for use of Indian Standards Institution certification mark on metal clad switches, 15 and 30 amp., 250 volts grade, conforming to IS: 1567-1960.

2. A licence has been issued to Murlidhar Jhunjhunwala Private Ltd., Madras, for use of Indian Standards Institution certification mark on BHC water dispersible powder concentrates conforming to IS : 562-1958.

3. A licence has been issued to E.A.G. Minerals Supply, Calcutta, for use of Indian Standards Institution certification mark on BHC dusting powders conforming to IS : 561-1962.

4. A licence has been issued to the Sial Soal Stone Factory, Rupaund, for use of Indian Standards Institution certification mark on BHC dusting powders conforming to IS : 561-1962.

5. A licence has been issued to Shalimar Tar Products (1935) Ltd., Bombay, for use of Indian Standards Institution certification mark on bitumen felts for water-proofing and damp-proofing Type 3, Grade 1, conforming to IS : 1322-1959.

6. A licence has been issued to Prabhat (Stove & Lamp) Products Co. Private Ltd., Bombay, for use of Indian Standards Institution certification mark on oil pressure lanterns confirming to IS : 1384-1959.

7. A licence has been issued to the Sharif Electrical Works, Bombay, for use of Indian Standards Institution certification mark on three-phase induction motors up to 20 h.p. only conforming to IS : 325-1961.

8. A licence has been issued to Hind Tin Industries, Calcutta, for use of Indian Standards Institution certification mark on 18-litre square tins confirming to IS : 916-1958.

9. A licence has been issued to Prabhat (Stove & Lamp) Products Co. Private Ltd., Bombay, for use of Indian Standards Institution certification mark on blow lamps conforming to IS : 1899-1961.

INSTITUTION NEWS

Dr. T. Sen, President-Elect of the Institution for 1962-63 —a Brief Life Sketch

Dr. Triguna Sen was born on December 24, 1905.

After graduating in Mechanical Engineering, Dr. Sen worked as an Instructor in the College of Engineering and Technology in Jadavpur. With a scholarship from the Deutsche Academie, Dr. Sen went to Germany for post-graduate studies. He obtained his Doctorate in Mechanical Engineering specializing in Fluid Mechanics and Hydraulic Machinery and worked in different firms in Germany.

On his return from Europe in 1932, Dr. Sen was arrested under Bengal Ordinance, put in a detention camp, and after a year was externed from the then Presidency of Bengal. In 1939, the ban on him was lifted. In 1943, Dr. Sen returned to Bengal from Dibrugarh where he had been working as Engineer and Manager of the Dibrugarh Electric Supply Co. during the period of his externment.

Dr. Sen worked as Administrative Officer and then as Principal of the College of Engineering and Technology, Jadavpur, till 1956, when he was appointed Vice-Chancellor of the Jadavpur University, the post he still holds. For two successive years, in 1958 and 1959, he was elected Mayor of Calcutta.

In 1957, Dr. Sen went to North America and Europe to study the systems of education in the different universities. In 1959, he went to Germany to study the administration of universities, and in 1960, to France to study the system of education in higher secondary schools in that country.

In 1961, and again in 1962, he was elected President of the Association of Principals of Technical Institutions (India).

Dr. Sen is now connected in various capacities with several institutions: *Academic* : Rector (Vice-Chancellor), Jadavpur University; Principal, College of Engineering and Technology, Jadavpur, Calcutta; Member of the Senate, Calcutta University; Member, Faculty of Engineering, Gauhati University; Member, Executive Council, Inter-University Board of India; Member, Association of Universities of the British Commonwealth; Member, All-India Council for Technical Education, Government of India; Member, Eastern Regional Committee, All-India Council for Technical Education, Government of India; Member, Central Advisory Board of Education, Government of India; Member, Indian National Commission for Cooperation with UNESCO; Member, Council of the Indian Institutes of Technology; Member, State Council for Technical Education, Government of West Bengal; Member, Board of Governors, Durgapur Regional Engineering College; Member, Governing Body, Birla Institute of Technology; Member, Governing Body, Ramakrishna Mission Shilpa Vidyapith; Member, Governing Body, School of Printing Technology, Calcutta; Vice-President, Governing Body, Acharyya P. C. Ray Polytechnic, Jadavpur, Calcutta; Member, Governing Body, Dhanbad School of Mines; Member, India International Centre. *Scientific :* Vice-President, Indian Association for Cultivation of Sciences; Member, Executive Council, Indian Science Congress Association; Member, Governing Body, Central Mechanical Engineering Research Institute, Durgapur; Member, Governing Body, Birla Industrial and Technological Museum, Calcutta; Member, Council of Scientific and Industrial Research. *Professional :* Member of the Council, The Institution of Engineers (India); Member, The Institution of Mechanical Engineers, U.K.; President, Association of Principals of Technical Institutions (India). *Cultural :* President, South Calcutta Rotary Club; Member, Indian Council for Cultural Relations; Member, Academy of Fine Arts; Vice-President, German-Indian Association; President, Indo-Czech Cultural Society; Member, Indo-American Society; Vice-President, Indo-Soviet Cultural Association; President, Safety First Association of India, Bengal; Member, Governing Body, Ramakrishna Mission Institute of Culture. *Public Corporation :* Director, Central Board, and Vice-President, Local Board, State Bank of India. *Public Limited Company :* Director, Jay Engineering Works Ltd., Calcutta. *Private Limited Company :* Director, Durgapur Projects Ltd. Dr. Sen is also Lt.-Col., National Cadet Corps.

FORTHCOMING CONFERENCES

The London International Engineering Exhibition, April 23 to May 2, 1963

The London International Engineering Exhibition, which takes place in Earls Court and Olympia simultaneously from April 23 to May 2, 1963, will provide a show-ground for engineering products manufactured all over the world. New machinery and materials from Austria, Belgium, Canada, Denmark, France, Finland, Holland, Hungary, Italy, Poland, Switzerland, the Soviet Union,Yugoslavia and the U.S.A. will be on show, whilst exhibits from Japan and Hong Kong are included amongst contributions from the Far East. At Earls Court, nearly 15,000 sq. ft. of stand space will be occupied by leading research and development organizations who will be demonstrating equipments and methods which may form the basis of new technologies and industries to be established in the coming decade. One-day conferences to be held throughout the exhibition will be organized by leading technical bodies including the Institute of Plant Engineers, the Society of Engineers, the Institute of Hospital Engineers, the Institute of Engineers-in-Charge and the Institute of Sewage Purification, whilst group exhibits will be mounted by others including the Gauge and Tool Makers' Association and the British Oil Burner Manufacturers' Association.

The 1964 Electrical Engineers Exhibition, London, March 18-25, 1964

The 1964 Electrical Engineers Exhibition will be held at Earls Court from March 18-25, 1964. For the first time, overseas manufacturers are expected to take part in this exhibition. Details can be obtained from the General Manager, Electrical Engineers Exhibition (A.S.E.E.) Ltd., 6 Museum House, 25 Museum Street, London, W.C.1.

BOOK ACKNOWLEDGMENTS

1. **A Text-Book of Sanitary Engineering.** G. B. Kanuga. *Khanna Publishers*, Delhi, Rs. 9.00. 334 pages.

The book covers the usual fundamentals of the subject, and includes a discussion of typical solutions to local problems.

2. **Practical Plane and Solid Geometry.** A. Shariff. *Asia Publishing House*, Rs. 12.00, 2nd edition. 334 pages.

This text-book covers geometrical constructions, practical solid geometry, isometric, perspective drawing, etc., explained in a simple manner. The basic principles are explained with illustrations and worked out examples are embodied in the text.

3. **The Electronics of Laboratory and Process Instruments.** V. S. Griffiths and W. H. Lee. *Chatto and Windus Ltd., London*, 50s. 368 pages.

This book is intended for the technologist who wishes to gain a working knowledge of the operation of some electronic instruments in general use in control laboratories. The first part of this book reviews the behaviour of resistances, and of inductances under direct and alternating voltages. Various types of valves and photo-cells are also described. Application of these valves and of other ancillary devices are dealt with in a general way. A brief outline of semiconductor devices is included. The second part of the book deals with apparatuses like *p*H meters, conductivity bridges, dielectric constant bridges, spectrophotometers, etc., and also references to industrial applications and the elements of control theory.

4. **Fundamentals of Semiconductor and Tube Electronics.** H. A. Romanowitz. *John Wiley & Sons, Inc.*, $7.25. 720 pages.

Requiring only a knowledge of elementary algebra and trigonometry, this book endeavours to embrace the fundamental theory and practice of both tube and semiconductor electronics. In analyzing circuit performance, basic concepts of physics and electrical engineering are drawn upon for clarification. A review of basic circuit theory, an introduction to the use of the multimeter, the vacuum tube, voltmeter, and the oscilloscope serve to introduce the reader to the commencing pages of this volume. Amongst the special features are the introduction of microminiaturization in theory and practice, and of switching and pulse-shaping circuits, Zener and tunnel diodes, magnetic amplifiers and photo-electric control circuits. A chapter is devoted to practical circuits illustrating applications of the basic principles. An instructors' manual and a laboratory manual are available for use with the book. The book also includes review questions and problems of which some are worked out in the text itself.

5. **Six-Language Dictionary of Automation, Electronics and Scientific Instruments.** Compiled by A. F. Dorian. *Iliffe Books Ltd.*, 105s. 732 pages.

This multilingual dictionary of technical phraseology in English, French, German, Italian, Spanish and Russian is designed to enable the engineer, scientist or technologist to understand the latest technical publications in any one of the six principal languages. The dictionary is divided into six parts, one part being allotted to one of the six languages. The English part has been treated as the key glossary with equivalents in other five languages. All the English words are arranged in alphabetical order, each word being preceded by an index number against each. English words in the same row appear as the same words translated into French, German, Italian, Spanish and Russian. The dictionary itself is followed by the five indexes and the problem of translation from one of the languages to any other is very much simplified. The preface, translated into the five languages, gives full instructions for the use of the dictionary.

6. **Involute Gear Geometry.** W. A. Tuplin. *Chatto & Windus Ltd.*, London, 40s. 188 pages.

This is an unconventional analysis from first principles of the characteristics and techniques of involutes of gears considered as pieces of metals which have to be cut with precision by simple tools to work as essential in assemblies of machinery. The classically academic belief that crossed-helical gears have only very low load capacity is examined from practical point of view, and derivation of every relevant formula is given with the aid of principles that are applicable to all types of gears.

7. **Handbook of Non-Parametric Statistics.** J. E. Walsh. *D. Van Nostrand Co., Inc.*, $15.00. 549 pages.

This handbook comprises a comprehensive presentation of a large number of non-parametric probability information procedures of practical significance in modern scientific research. The methods in this book are widely appreciable to the data of science, engineering, medicine and other related fields.

OBITUARY

The sympathy of the Institution is extended to the relatives of those whose passing is recorded here.

Shri Panna Lal Verma

Shri Panna Lal Verma, B.Sc., B.Sc. (Engg.), M.I.E.E., M.I.E., died on October 6, 1962, at the age of 64.

Shri Panna Lal Verma was born in Punjab on March 1, 1899, and after obtaining his B.Sc. in India, he went to the U.K. for further studies in electrical and mechanical engineering. He obtained his degree from St. Andrews University, Scotland. He joined the Electrical Department of the then Bombay, Baroda and Central India Railway which at that time was undertaking the electrification of its Bombay suburban section. He was sent to England on deputation for training in electric traction for a period of four months in 1926. Soon after his return, he was posted as an Assistant Electrical Engineer in the B.B. & C.I. Railway and was connected with the electrification work of its suburban service. In 1935, Shri Verma became Officiating Divisional Electrical Engineer (Traction) and was confirmed as Divisional Electrical Engineer in 1941. In 1947, he was posted as an Officer-in-Charge of the survey work of the mainline electrification of the B.B. & C.I. Railway between Bombay and Ahmedabad. In February 1948, he was transferred to the then Great Indian Peninsula Railway as Officiating Traction Superintendent, and was soon confirmed in the same post. In 1952, when the G.I.P. Railway was reorganized and was renamed as Central Railway, Shri Verma became the first Chief Electrical Engineer of the Central Railway in September 1952. He was sent on deputation in 1953 by the Railway Board to France and Belgian Congo to study and report on the system of A.C. electrification of Railways. He continued in this post of Chief Electrical Engineer till he retired in the year 1954. Shri Verma was a member of the Bombay Local Committee of the Institution of Electrical Engineers (London) from 1947 to 1952, and in the year 1952, he was elected Vice-Chairman. In 1953, he was elected Chairman of the Bombay Committee and continued till 1956. From 1956 to 1959, he was a member of the Committee.

Shri Verma joined the Institution as Member in 1951.

CORRIGENDA

TO VOL. 12, NO. 2, OCTOBER 1962

Page 23, line 4 : instead of '*Non-member*', please read '*Associate Member*'.

Page 73, under 'Institution News.' line 2 : instead of 'Government of Orissa', please read 'Governor of Orissa'.

TO VOL. 12, NO. 3, NOVEMBER 1962

Page P15, line 28 : instead of 'Desirability of Assessment of Teamwork in Engineering Institutions', please read 'Desirability of Assessment of Term Work in Engineering Institutions.'

EMPLOYMENT SERVICE

This service is intended for the benefit of members of the Institution and for the Government, industrial and other organizations employing engineers. It is hoped that the employers will make full use of this service to obtain their requirement.

A small charge of Rs. 5 per insertion will be made to members for notices appearing in the 'Situations Wanted' column.

In the 'Situations Vacant' column a charge of Rs. 2 per line will be made.

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UNIVERSITY

THE BULLETIN
OF
The Institution of Engineers (India)

SECRETARY & EDITOR: B. SESHADRI, B.Sc., A.I.I.Sc., D.I.C., M.Sc.(Eng.), M.I.E.

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FRANCE PAYS HOMAGE TO GUSTAVE EIFFEL— PIONEER IN THE SCIENCE OF AERODYNAMICS*

Pierre Devaux
Non-member

France is at present engaged in paying homage to the memory of one of its most celebrated construction engineers : Gustave Eiffel, father of the Eiffel Tower (Fig. 1).

Gustave Eiffel, who was born in 1832 and died in 1923, actually built his famous tower (Fig. 2), for the 1889 World Fair. However, this year is the fiftieth anniversary of a less bulky but equally typical moment, *viz.*, the Paris Aerodynamics Laboratory, built in 1912 with such scientific foresight that it is still used for studying bridges, airplanes, pylons, ships and power plants (problems of smoke and fumes), as well as problems relating to the lift of helicopters and planes.

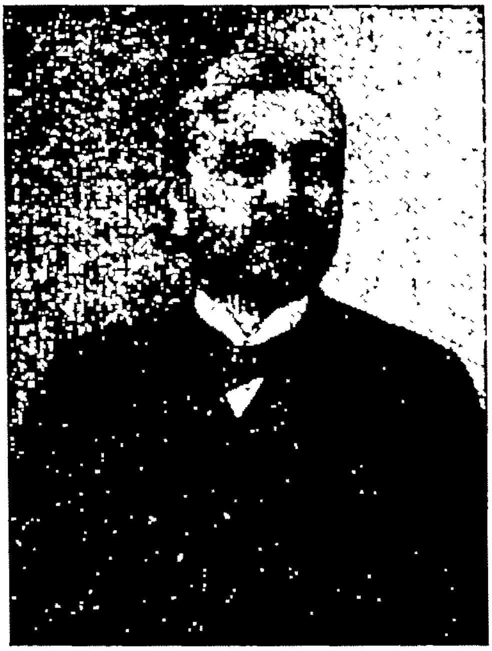

Fig. 1

Gustave Eiffel

The miracle of enormous bridges

One of the leading difficulties Gustave Eiffel struggled against all his life was how to overcome the wind, the destroyer of large structures.

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* Received from Centre Cultural Francais, Calcutta.

There is a typical anecdote concerning the completion of the famous railroad viaduct bridge at Garabit, over the 122 m. deep gorge of the Truyére (Fig. 3). The two central halves of the central span, which is 165 m. wide, were built jutting out from either cliff of the gorge where they were maintained by cables. All that remained to be done was to lower these two enormous structures towards one another and rivet them together. However, there was the constant danger of a gust of wind coming along, as it does frequently in the mountains, and dashing the entire structure, the workers and Eiffel himself to the bottom of the chasm. When informed of this danger, Eiffel replied simply, 'there will not be any wind !'

Along with Résal, father of the Pont Mirabeau, of Séjourné and an engineer noted for his great vaults, Eiffel was the precursor of modern designers of gigantic structures such as Albert Caquot, Fraissinet and Coyne. He was responsible for many extremely daring bridges throughout the world. Prior to him, the pilings and vertical members were made of cast iron. It was Eiffel who began to use aerial laceworks of metal lattice work looking like spider webs silhouetted against the sky.

Eiffel's masterpiece : the Eiffel Tower

The Eiffel Tower is not only an illustrious monument to techniques of construction, but it has also become the symbol of Paris in pictures and posters throughout the world. Originally, it was built as the triumphal portal of the World Fair held on the Champs-de-Mars. Its incurving parabolic shape is that of the 'most resistant solid'.

Eiffel said, 'I built it like the piling of a bridge 300 m. high !'

The Eiffel Tower is no longer the tallest monument in the world ; it was first passed by the Chrysler Building and then by the Empire State Building, both of which are in New York city ; but it still retains all of its initial prestige. Since its construction, it has been used for an increasing multitude of scientific purposes—weather forecasting, climatology, atmospheric aerodynamics, and radio and electricity. The different stories of the tower now contain very modern weather detecting instruments which automatically relay information and statistics to the Central Weather Bureau on Avenue Rapp.

During storms, the tip of the Eiffel Tower wavers back and forth in an oval 10 cm. long. The unequal expansion of the girders under the heat of the sun also moves the peak of the tower along a bean-shaped curve, with the central depression in the beam corresponding to the cooler hours at night. The new television antenna has increased the height of the tower from 301 to 322 m.

Whereas the very top of the Eiffel Tower (the third platform and the television antenna) plunge into the layer of bad air which hangs over all large cities, the 'micro-climate' of the second platform is so pure that Dr. Hénocque even proposed the installation of a convalescence service for patients suffering from respiratory infections !

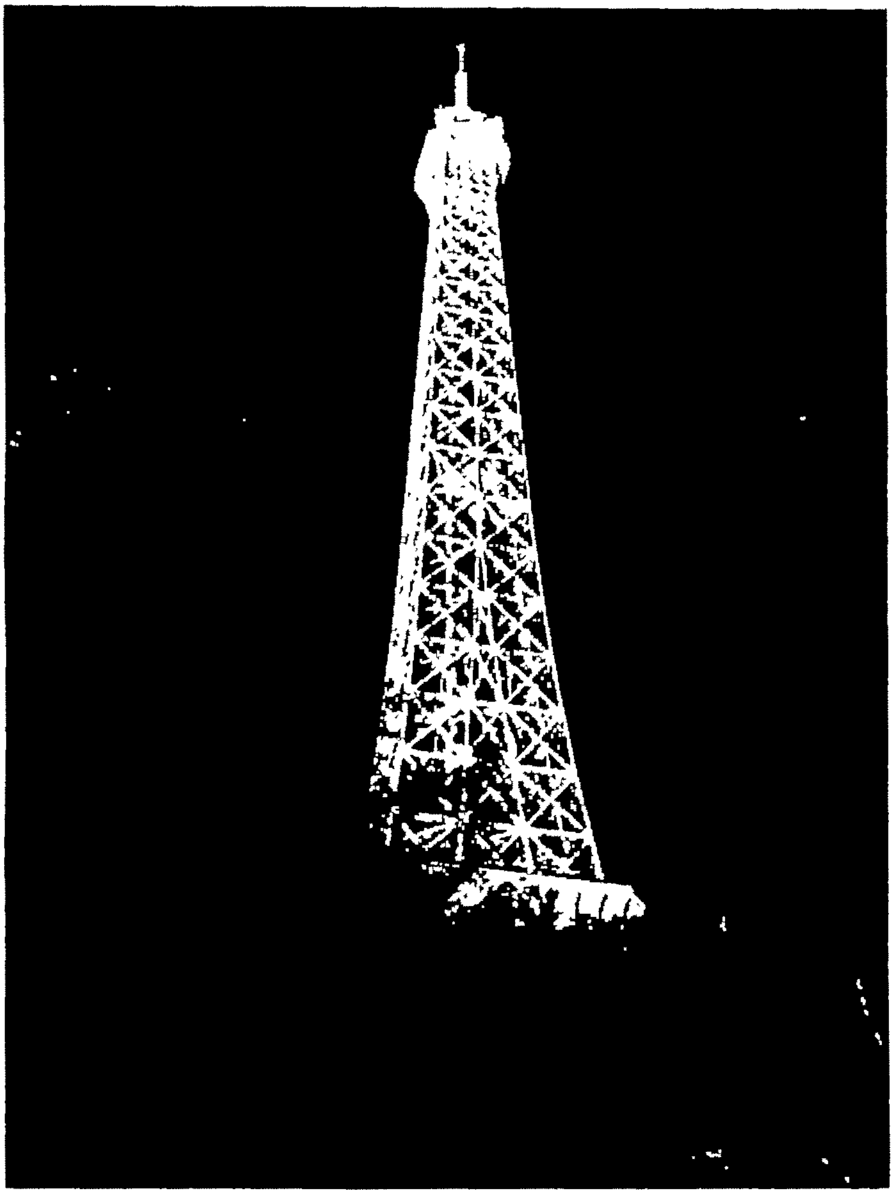

Fig. 2 •

The Eiffel Tower

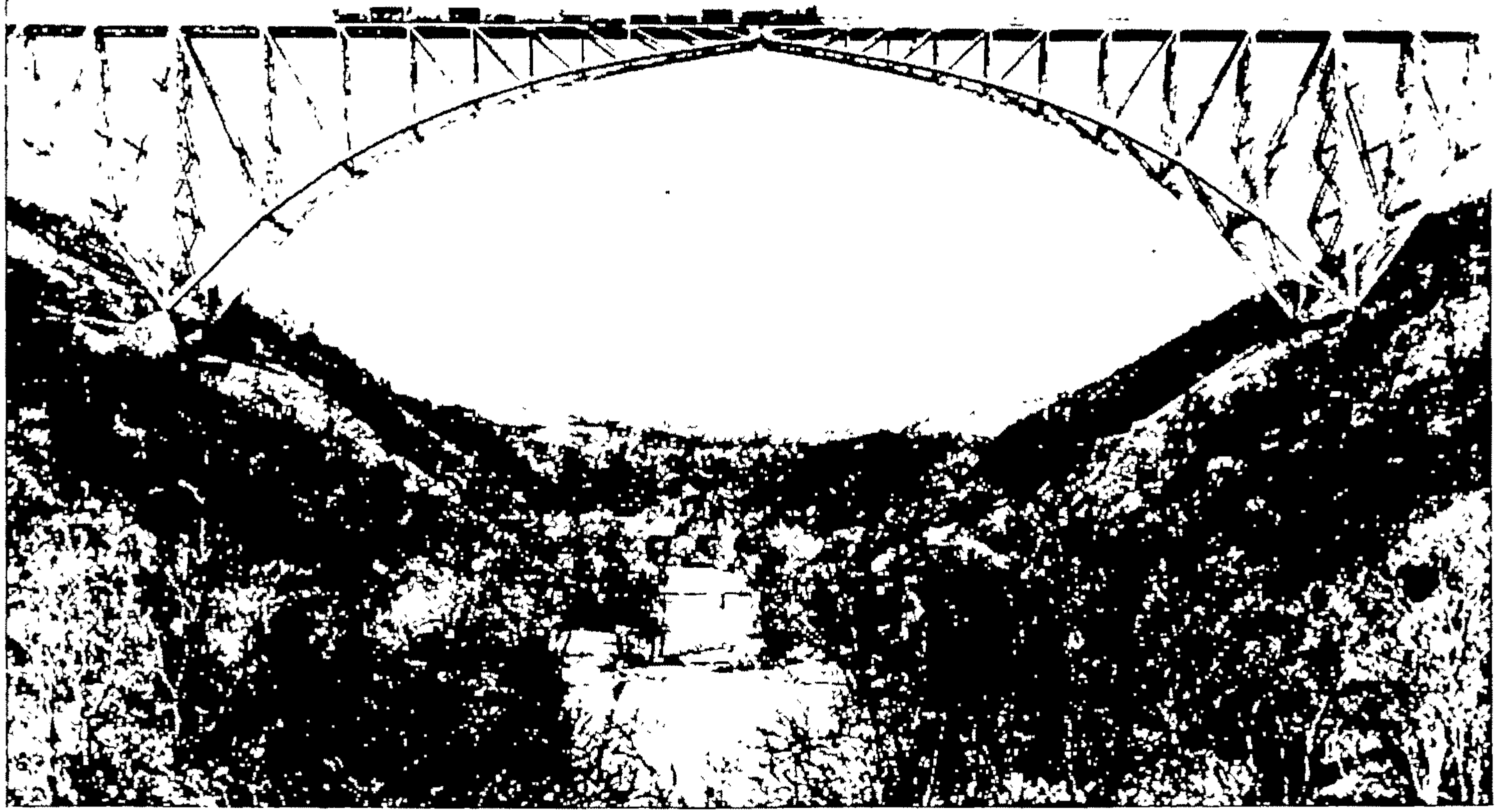

Fig. 3

Viaduct bridge at Garabit over the gorge of the Truyere

This idea was taken up under a slightly different form, and a pre-tubercular observation ward was set up on the top floors of the Nouveau-Beaujon Hospital.

Enemy number one : the wind

In order to fight an enemy, one must be well acquainted with him. In 1909, Eiffel chose a site on the Champs-de-Mars for the construction of a modest wind tunnel, 1.5 m. in diameter and 3 m. long, and generating an artificial air stream at the rate of 20 m. per sec. (72 km. per hr.). Voisin, Farmann, Esnault-Pelterie, Nieuport and all the other great French pioneers in aviation pried out their models in Eiffel's first laboratory.

When the new residential districts were built on the Left Bank in 1911, Eiffel had to move his installations to Rue Doileau in the Auteuil region. The diameter of the tunnel was increased to 2.5 m., and the wind speed to 30 m. per sec. Many copies of this wind tunnel were subsequently made in France, in Holland, in the United States and even in Japan.

Other much larger wind tunnels were made such as the French Aerodynamic Laboratory in Modane which is powered by Alpine streams, but the basic principle is still the same.

Modern wind tunnels

Whereas Eiffel's laboratory was rather small compared with modern wind tunnels in which full scale planes are tested, it nevertheless remains of great value in studying modern devices such as, in particular, vertical flight craft ; the Coléoptère, helicopters and hyperlifting devices.

The tendency in modern wind tunnels is to increase the velocity of the wind to supersonic speeds (more than Mach 1, or nearly 340 m. per sec.). However, it must also be remembered that low speed tests are equally important in aviation research.

A plane reacting from a powerful upward lift with its wing flaps up, or a helicopter with its rotor turning with a hover position, weights nothing at the instant it comes into contact with the ground. At such a moment, a gust of wind could easily upset the craft. The same is true of missiles on departure, which is why they begin their climb with majestic slowness, guided by vertical instruments.

The conditions required for stability in such difficult moments are highly complicated, and much less is known about them than the conditions during flight. The Eiffel Laboratory is used for such studies with scale models. Other studies made at this laboratory include aerodynamic speed tests of automobiles which move relatively slowly, as well as tests of ships with high superstructures, airplane propellors, radar receivers, and, in short, any sort of structure which offers wind resistance and which is called upon to fight against Gustave Eiffel's old enemy.

PROBLEMS OF IRRIGATION AND POWER IN INDIA—SOME SUGGESTIONS*

Dr. K. L. Rao
Member

'The rate of increase of prosperity in India is entirely dependent upon the speed and efficiency with which work is carried out in the Ministry of Irrigation and Power. I venture to make some suggestions which may be of help.

Power projects

Considering first the 'power' position, in the First Plan, we installed a capacity of about a million kW, and in the Second Plan, about 2.3 million kW. Both these have fallen short of the target by nearly 30%. In the Third Plan, we have programmed to put in a capacity of 7 million kW, and as the conditions stand at present, it looks as if we will have a similar shortfall, and that will have a serious repercussion on the success of our Plans. Therefore, we have to pay particular attention as regard the achievement of the Third Plan targets.

It is necessary at this stage to know exactly or at least have an idea of what should be our minimum power requirement to attain the take-off stage. For this purpose, we need not compare ourselves with a country like the U.S.A., which shows a consumption of 4,000 kWh per head, while ours at present is of the order of about 39 kWh only. We can compare ourselves better with some of the countries of Europe. These countries (of Europe) fall under three types, *viz.*, (i) prosperous countries like England and the Scandinavian countries where the consumption per head is of the order of 2,000 to 4,000 kWh; (ii) semi-prosperous countries like France with a consumption of about 1,400 kWh per head; (iii) poorer countries which are just trying to develop and have just got to the take-off stage. We do need to make a study of countries like Spain and Yugoslavia where the consumption is 300 to 400 kWh.

Adopting a figure of 300 kWh per capita and making corrections for the increase in population that we will have in the next fifteen years, it is proper to say that we should have about 48 million kW of installed capacity in the country to reach the take-off stage, and this has to be the power programme of our country for the next fifteen years, though it is a target we should achieve.

It is possible to achieve this provided we make plans and set about them in a regular and systematic manner. The first requisite, of course, is the manufacture of generating equipment and transformer and substation equipment in our country. It means that our capacity for manufacturing these electrical machinery has to rise from Rs. 3 crores to about Rs. 250 crores per year. Of these Rs. 250 crores, nearly 70% is represented by the generating capacity, and, therefore, it is necessary that we should make use of the three plants at Bhopal, Hyderabad and Ranipur for the manufacture of generating equipment. The remaining 30% of the work can be assigned to the private sector.

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* An extract from a speech delivered in the Lok Sabha on May 18, 1962, on 'Demands for Grant in Respect of Ministry of Irrigation and Power.'

With the help of the workshops in the country, these items can be manufactured, while we should concentrate on the generating equipment wholly to be manufactured in the three electrical plants.

There is one point which I like to point out at this stage, and that is, it is very necessary for us to see that these electrical plants do not spend large sums of money on buildings and workshops, and so on. There is a tendency in India to exaggerate and construct factories on on extensive scale. Take, for example, the case of the Toshibo Factory in Japan. It is located in a small area of about 50 acres, and is manufacturing mighty machines, whereas we require hundreds of acres which involve large sums of money from levelling onwards, and even when foreign collaborators come here, they seem to get also into the same bad habit. They seem to think in terms of the large size of our country and draw up the plans on a lavish scale. We should resist this and try to curtail the building programme so that our manufactured equipment may not cost much.

There is also another reason. All equipments get obsolete in a few years. I understand that circuit-breakers, switchgear, etc., which are being manufactured at Bhopal have already become obsolete; *i.e.*, the type being manufactured has become obsolete. I saw in London last year a complete thermal station with a chimney being pulled down, though it had not yet been commissioned, because it was found that another technique had been developed by which it was possible to achieve greater economy. We should, therefore, observe greater austerity in the matter of buildings. This is just by way of an observation.

But there is another important point that we have to consider carefully in our programme to manufacture generating equipment at these three plants. We have programmed this manufacture on the basis of 3.3 million kW of thermal machines and 1.7 million kW of hydro machines. That is just the thing that should not have been done. The economy of the country requires that we should have more hydro power stations than thermal. It is a very serious matter for consideration, and we should now try to see that this manufacturing programme is reversed.

I say so because the equipment required for a hydro station costs only about Rs. 150 per kW, whereas, for a thermal station, the requirement is of the order of Rs. 500. There is, besides, a capital investment of about Rs. 300 by way of coal mining and washing. It is not only this; a thermal station with a capacity of 100,000 kW will require daily transport of 50 wagons of coal, which, under the present conditions, is very difficult. The fact that a complicated hydro scheme like the Kundah could be constructed in three and a half years' time and made to generate power is an important lesson for us to note, because it is often felt, and erroneously, that thermal stations are quicker to be erected then hydro stations. There is also another important factor, *viz.*, the coalfields are very few in number in India, and they are located in isolated pockets. In those areas, of course, we can have thermal stations. However facilities for hydro stations exist all over India. Take the case of the Koppili project in Assam, the Tons project in Uttar Pradesh, the Punasa project in

Madhya Pradesh, the Beas-Sutlej link in Punjab, or the Salal project in Jammu and Kashmir, the Kalinadi and Barpole projects in Mysore, the Idikki project in Kerala, or, the Srisailam project in Andhra Pradesh. There are many hydro projects spread all over the country, and we should first exploit these before we go in for thermal stations on an extensive scale.

In this connection, I like to mention that in the matter of the policy we follow for sanctioning projects, we should have a different attitude. For example, take the Third Plan projects; we sanction them towards the middle or end of the Third Plan, and then find that there is no time for detailed investigations, and so just get into the actual construction, only to meet with many difficulties and surprises ; and the measures we take to overcome these in haste lead to a great wastage. By doing this, we are short-circuiting an important stage, that of detailed investigations and preliminary works. It is, therefore, very essential that we should plan out these things on a basis of a ten or fifteen year period. That is what is done in all foreign countries. For example, with regard to the projects I mentioned just a while ago, we should now commit ourselves and fix up the projects we would undertake during the next ten or fifteen years, and straightway sanction them in the sense that those concerned can go ahead with the detailed investigations such as foundation explorations, approach roads, bridges and buildings, etc. Then only we can have a sure realization of our targets.

Take, for example, the Punasa project in Madhya Pradesh, which is one of our most important projects and is almost a treasure-house for Madhya Pradesh. The project was investigated in 1951. It is still in the same preliminary investigation stage, whereas in ten years it could have been constructed most economically and a large amount of power added to benefit the large tracts of Central India.

There is also another aspect. In respect of designs for small thermal stations of 100,000 kW, we are paying as much as Rs. 50 lakhs by way of foreign exchange. This should be stopped. Thermal station design is simple one and can be done in this country provided the Ministry makes up its mind to institute an organization for it. When we want to instal millions of kW capacity in the country by constructing thermal stations, it is meaningless that we should be spending valuable foreign exchange for obtaining designs. It is essential that designs should be done in India itself. If the Ministry cannot do it, then private concerns may take up this work to avoid outflow of foreign exchange.

It is necessary to remember that in the First Plan we spent Rs. 150 crores, and in the Second Plan Rs. 430 crores on power projects. In the Third Plan, we will be spending Rs. 1,020 crores, and in the Fourth, Rs. 2,000 to 2,400 crores. It is therefore necessary that we must have close liaison with the manufacturers of power equipment. If we cannot manufacture power equipment in our country and have to obtain them at a heavy cost from outside, it is all an idle talk to think of any kind of power. Therefore, the manufacture of equipment should be taken hand in hand with the development of power.

Consider the railway administration and some other departments. They are manufacturing their own diesel locomotives I suggest that we should have a separate Ministry for power and power industries. It is only then that we would be able to concentrate on power generation in this country on the scale I have mentioned.

I submit that a change is necessary in the Ministry. Our I.C.S. and I.A.S. officers come from the most intelligent section of our people. They are the pride of our nation. Nevertheless, I should mention that technical organizations and Ministries like Irrigation and Power should be headed by men with technical knowledge, men of broad vision, men who have implicit belief in the immense possibilities of technological developments. These qualities can come only from engineering studies and experience. Therefore, irrespective of the considerations that prevailed in the past, it is essential, if we are to develop, if we are to achieve the prosperity of technological revolution, that technical organizations, technical bodies and technical ministries, whether at the Centre or at the State level, must be headed by engineers.

Given trust, treated as equals, and fixed with responsibility, you will find that even under difficult conditions, there will be no difference between the targets and the achievements, when the engineer is told to do his work.

Irrigation

On the question of irrigation also, I have to say a few words. In the First Plan, we spent Rs. 430 crores, in the Second Plan Rs. 420 crores, and in the Third, we propose to spend Rs. 600 crores. In spite of all these, we have not even tackled some of the rivers. The Narmada is not touched at all, the Godavari is scarcely touched. A lot of water is going down the rivers, which is a visible manifestation of the waste of our natural wealth. It means that in the future plans we have got to construct projects worth several crores of rupees.

Minor irrigation has already been referred to, but I am dealing with it from another point of view. All minor irrigation works costing between Rs. 1 lakh to Rs. 10 lakhs must be transferred to this Ministry. I am looking at it from the engineering point of view. Many of these projects are designed and executed in an uneconomical way. A lot of money can be saved if it is handled by competent engineers. So I earnestly request that all these minor irrigation projects must be transferred from the Ministry of Agriculture to this Ministry. Of course, for the purpose of maintenance and other works, the latter can also be associated, but essentially, minor projects inviting engineering techniques should be transferred.

There is another important point. In the First, Second and Third Plans, the number of projects totalled 550. Of these, 22 are major projects each costing more than Rs. 20 crores. The total cost of these 550 projects is Rs. 1,750 crores. More than one-half of this cost is taken up by the 22 major projects. But there is an added advantage in this. If you launch a major project, the benefits derived from it are about 10 to 40% higher than from medium projects of equal value. There is not only certainty about water supplies, but also the benefits from large projects are far more than those from small and medium projects of equal value. Therefore, we have begun some of these large projects, but there is a difficulty in financing. When these projects are included in the State Plans, there is handicap for the States concerned.

Let us take the examples of the States of Bihar and Andhra Pradesh. In Bihar State, there are the Kosi and Gandak projects. We have included them in the State Plans. That means to say that there is no more money for medium projects.

Similarly, in Andhra Pradesh, there is the Nagarjunasagar project which costs about Rs. 140 crores. It has gone on from the First Plan to the Second Plan also. Thus a huge sum of money from the State Plan is devoted only to this and there is no money for other medium projects. What happens then? All the major projects like this benefit only one or two districts. There are many other districts in every State, and the people there naturally get dissatisfied. If we have succeeded in completing the Bhakra, the D.V.C. and the Hirakud projects in time, it is because we have given money to them in the First Plan from the Centre.

We are now having the Farraka barrage built by help from the Central Government. Supposing we make that provision in the West Bengal State Plan, it would be impossible for the State to be free to begin other projects. Therefore, in the case of major projects costing more than Rs. 20 crores, a separate provision should be made in the Central Budget, from which at least a portion should be advanced to the State.

There is another aspect which I want to touch upon. We should keep a watch on our technical frontiers. The total population of the world is 290 crores and in about 40 years, it will be doubled. That means, there will be no more food coming to us from the outside. We must take advantage of the present times and try to develop plans to obtain as much food as possible. To achieve this, we cannot go on with the conventional or ordinary methods. We have to do something different; we have to be more scientific. We must try to gain lands from the deserts, from the marshes and from the sea.

For example, there is an excellent opportunity for reclaiming the Rann of Cutch, 10 lakhs of acres of excellent land which can be put straightway under cultivation. The only trouble is, that once having been under the sea, the land has a large salt content. We have to wash it and find out what kind of crops can be grown. It really means some experimentation. If the Centre does not undertake to do this because the State has to do it, reclamation may take some time, thereby causing loss of time and a precious opportunity for the country to develop economically and reclaim land from the sea. It is essential, in my opinion, that we should immediately take up such schemes because these can give us food.

Speaking on the question of inter-State allocation of the waters of the Godavari and the Krishna, Dr. Rao suggested the following solution.

It is necessary to treat the two rivers Krishna and Godavari separately. They are entirely different rivers with different characteristics. They have about the same catchment area. One gets its waters from the Western Ghats and the other from Central India. The Godavari carries twice as much water as the Krishna. Let us consider the Godavari alone first and leave out the Krishna for a while; we can get a special report from the Krishna and Godavari Commissions and the concerned papers from the Central Water Power Commission and resolve to sanction the projects.

Now, once we do that, we will have created an atmosphere of reality. Then we may come to the Krishna projects. There are some projects on the Krishna located in various States which have been included in the Third Plan; they are useful ones—the Koyna irrigation project in Maharashtra, the Malaprabha and the Upper Krishna projects in Mysore, and the hydel project at Srisailam in Andhra. It will take two or three years before they reach a stage when they can start work. After sanctioning them and giving them a further time of two or three months, adjustments can follow very easily. Viewed in this way, it will be possible for us to solve problems of inter-State controversy. We can thus set an example for the other river systems in the country and also a pattern for their harmonious integration.

Flood control

We have spent about Rs. 40 crores in the First and Second Plans, and I believe we have provided a similar sum in the Third Plan. This amount is very inadequate for extensive flood control work. It is true that we do not have enough money. India is a vast country and it is subject to heavy rainfall. Therefore, floods are bound to occur and we should utilize them to the maximum advantage. I suggest taking up that region which is always subject to floods—the region east of Uttar Pradesh, Bihar, Assam, and north Bengal. This is subject to floods every year because there is drainage congestion due to topographical features. Orissa is another State where man-made troubles arise. People have occupied the tracts of rivers and the river- ends are chocked and there is inundation. So, whenever there is heavy rainfall, floods are inevitable. Let us have an organization which can take care of these emergencies. In other words, we must have a body equipped with helicopters and other engineering equipment and materials that are needed for this type of work. It must go into action on the 1st of June and go out on the 1st of November. There will thus be an organization which is prepared to go into action immediately an emergency arises. If we are thus prepared for the floods that are bound to occur in these areas and take steps, we will have done a great service to the people. The people will have faith, courage and a feeling that there is a body which is ready for action as soon as the floods come and the damage will be mitigated. Simultaneously, with the money available, flood control works can be undertaken.

Need for technological advancement

I want to emphasize once again that the economic independence of our country is to be achieved only through technological developments, or, in other words, by energizing our engineers and scientists. That is how Britain held its sway not because of the British sword as generally believed but because of its technological superiority. The British had to their credit three inventions in the last century; steam locomotives, electricity, and manufacture of steel. Likewise it is very necessary for us to achieve technological development. It is power that is most essential for eliminating poverty; it is power that will give universal employment and also purchasing power. We must go on producing more and more power, using all means. For instance, in Bhavnagar we get tidal waves. The difference between the ebb tide and the flow tide is 35 ft. We can generate power from these tides. Power is being produced from tides in France. Continuous technological advance is necessary to produce more and more power in our country.

Conclusions

We are taking all sorts of steps to increase our production. But, at the same time, we must remember that when India was one of the greatest exporters of wheat and other grains, many people in India were dying of hunger and starvation. Hunger and starvation can be banished only by socialism, and socialism is sought to be attained in this country by *Panchayat Raj*. Therefore, it comes to this; *Panchayati Raj* and power are the two horses on which the nation has to ride towards prosperity. So far as this Ministry is concerned, it contributes to both of them. The various projects all over the country are a standing tribute to the good work that is being done by this Ministry'.

EQUIVALENT METRIC UNITS AND CONVERSION FACTORS

J. K. Varshneya
Non-member
Deputy Director (Metric)
National Buildings Organization, New Delhi

Introduction

With the changeover to the metric system, the present generation of serving engineers which is trained in the usage of British units is faced with many problems as regards equivalent metric units and conversion factors. What are the equivalent metric units for acre, hundred-weight, Btu or ton per square inch? What are the conversion factors to convert ton per square inch to kilogram per square millimetre or acre to hectare? These are some of the problems that the engineers will be constantly facing. In addition, during the first phase of transition, they will require conversion factors from the metric system to the British system also. When we say that the bearing capacity of a particular soil is 4 tons per sq. ft., the engineer immediately forms a picture in his mind about its magnitude; but when he is told that the bearing capacity of a soil is 43 metric tonnes per sq m, it will be difficult for him to grasp its exact magnitude unless he converts it into British units and correlates it with his present knowledge. This paper describes the metric equivalents of the British units and gives the conversion factors from the British to the metric system and *vice versa* in the tables below.

Table 1

Equivalent metric units and conversion factors

Serial number	Quantity	British unit	Equivalent metric unit	Conversion factor	
				British to metric	Metric to British
1	2	3	4	5	6
1	Length	inch (in)	millimetre (mm)	25.400	0.0394
		inch (in)	centimetre (cm)	2.540	0.394
		foot (ft)	metre (m)	0.305	3.281
		yard (yd)	metre (m)	0.914	1.094
		furlong	kilometre (km)	0.201	4.971
		mile	kilometre (km)	1.609	0.621
		nautical mile (U.K.)	international nautical mile (n mile)	1.001	0.999
2	Area	square inch (in^2)	square centimetre (cm^2)	6.451	0.155
		square foot (ft^2)	square metre (m^2)	0.0929	10.764
		square yard (yd^2)	square metre (m^2)	0.836	1.196
		acre	hectare (ha)	0.405	2.471
		square mile (sq mile)	square kilometre (km^2)	2.590	0.386

Table 1—(*contd.*)

1	2	3	4	5	6
3	Volume	cubic inch (in^3)	cubic centimetre (cm^3)	16.387	0.061
		cubic foot (ft^3)	cubic metre (m^3)	0.0283	35.315
		cubic yard (yd^3)	cubic metre (m^3)	0.765	1.308
		acre foot (acre ft.)	hectare metre (ha m)	0.123	8.107
4	Capacity	imperial gallon (gal)	litre (l)	4.546	0.220
5	Mass	pound (lb)	kilogram (kg)	0.454	2.205
		hundred-weight (cwt)	quintal (q)	0.508	1.968
		ton	metric tonne (t)	1.016	0.984
6	Linear density	lb/ft.	kg/m	1.488	0.672
7	Density $\left(\frac{\text{Mass}}{\text{Volume}}\right)$	lb/ft^3	kg/m^3	16.019	0.0624
		lb/in^3	g/cm^3	27.680	0.0361
8	Specific volume	ft^3/lb	m^3/kg	0.0624	16.018

Table 1—(*contd.*)

1	2	3	4	5	6
9	Momentum	lb ft/s	kg m/s	0.138	7.233
10	Moment of momentum	lb ft^2/s	kg m^2/s	0.0421	23.730
11	Moment of inertia	in^4	cm^4	41.623	0.024
12	Section modulus	in^3	cm^3	16.387	0.061
13	Force	lbf	kgf	0.454	2.205
14	Bending moment	lbf ft.	kgf m	0.138	7.233
		lbf in	kgf cm	1.152	0.868
15	Stress and pressure	lbf/in^2	kgf/cm^2	0.0703	14.223
		lbf/ft^2	kgf/m^2	4.882	0.205
		tonf/ft^2	tf/m^2	10.937	0.0914
		tonf/in^2	kgf/mm^2	1.575	0.635
16	Dynamic viscosity	Poundal second per square foot (pdl s/ft^2) = lb/ft s	Poise (P) = dynes/cm^2 = g/cm s	14.882	0.0672
17	Kinematic viscosity	in^2/s	Stokes (S) = cm^2/s	6.452	0.155
		ft^2/s	Stokes (S) = cm^2/s	929.034	0.001076

Table 1—(*contd.*)

1	2	3	4	5	6
18	Work and energy	ft lbf	kgf m	0.138	7.233
19	Power	horse power (hp)	kgf m/s	76.040	0.0132
		horse power (hp)	kilowatt (kW)	0.746	1.341
20	Temperature	°F	°C	$(F-32)\frac{5}{9}$	$(C\times\frac{9}{5}+32)$
21	Quantity of heat	British thermal unit (Btu)	calorie (cal)	251.996	0.003968
22	Heat flow rate	Btu/h	cal/s	0.070	14.286
		Btu/h	kcal/h	0.252	3.968
23	Density of heat flow rate	Btu/ft^2 h	kcal/m^2 h	2.712	0.369
24	Thermal conductivity	Btu/h ft deg F	kcal/h m deg C	1.488	0.672
		Btu in/h ft^2 deg F	kcal/h m deg C	0.124	8.064
25	Thermal conductance	Btu/ft^2 h deg F	kcal/m^2 h deg C	4.882	0.205
26	Calorific value	Btu/lb	J/g	2.326	0.430
		Btu/lb	cal/g	0.556	1.800

Table 1—(*contd.*)

1	2	3	4	5	6
27	Specific heat	Btu/lb deg F	J/g deg C	4.187	0.239
		Btu/lb deg F	cal/g deg C	1.000	1.0000
28	Consumption $\left(\frac{\text{Volume}}{\text{Length}}\right)$	gallon per mile (gal/mile)	litre per kilometre (l/km)	2.825	0.354
29	Consumption $\left(\frac{\text{Length}}{\text{Volume}}\right)$	mile per gallon (mile/gal)	kilometre per litre (km/l)	0.354	2.825
30	Illumination	foot-candle	lux (lx)	10.764	0.093
31	Brightness	candela per sq. in (cd/in^2)			
			stilb (sb)	0.155	6.452
		foot-lambert	lambert	0.001076	929.034

Note:
1 kilogram (kg) = 1.072 seer; 1 gram (g) = 0.0857 tola; 1 metric tonne (t) = 26.792 maunds; 1 seer = 0.933 kilogram (kg); 1 tola = 11.664 gram (g); and 1 maund = 0.0373 metric tonne (t).

References

1. B. S. 350—Part I: 1959.—British Standard for 'Basis of Tables Conversion Factors'.
2. ISO/R 31/Part I—1956. 'Fundamental Quantities and Units of MKSA System and Quantities and Units of Space and Time'.
3. ISO/R 31/Part II—1958. 'Quantities and Units of Periodic and Related Phenomena'.
4. ISO/R 31/Part III—1960. 'Quantities and Units of Mechanics'.
5. ISO/R 31/Part IV—1960. 'Quantities and Units of Heat'.

Summaries of Papers Published in the Journal, Vol. 43, no. 5, pts. CI 3, ME 3 & ET 2, January 1963

CIVIL ENGINEERING DIVISION

Role of Reservoirs in the Solution of Flood Problems.

N. S. Iyengar

Associate Member

The severity of flood hazards in a river valley intensifies gradually in stages over a period of several decades. The flood protection works are, therefore, to be built in stages using various methods in different stages. Some of the main features that come up for consideration in a flood control project are mentioned and an attempt is made to bring out the role of reservoirs in flood control. Observations and experiences gained in the Damodar Valley are included to illustrate the problems discussed.

Design of Column Foundation

A. S. Kenkare

Non-member

The paper deals with the derivation of a design formula relating the number of foundation bolts, bolt area, pitch circle diameter with the wind loading, dead load of the column and the allowable stress in the foundation bolts. To a fair degree of accuracy, it is found that the choice of bolts does not greatly depend on the column diameter. This is because the transverse moment on the column and the resisting moment in the foundation both vary linearly with the column diameter. The design formula derived in the paper leads to an increase in the number of bolts as compared with the number derived on the basis of the approximate theory, *viz.*, all bolts take an equal share of the moment due to wind load.

Maximum Flood Discharge*

K. B. Kushlani

Non-member

Drag on a Hemispherical Element in Open Channel Flow

Dr. A. G. Mirajgaokar

Non-member

In open channel flow, the drag on a large elemental roughness is a function of the Froude number, the Reynold's number, and the relative submergence of the object. This paper deals with the relationship of the above variables for a hemispherical

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*Summary of this paper was published in the July 1962 issue of the *Bulletin*.

roughness element fixed to the channel bed of a laboratory flume. A statistical formula relating the drag coefficient and the Reynold's number is presented.

Sedimentation in the Kosi—a Unique Problem

D. Mookerjea
Member
and
B. N. Aich
Member

The problem of silting in rivers is a bane as well as a boon to mankind. A study of the problem with reference to the River Kosi is made in this paper. The origin and characteristics of the Kosi River, the characteristics and trend of rainfall in its basin and the runoff and sediment charge details are dealt with. The silt charge and its effect on the life of the barrage is discussed briefly. Practical steps for control of silt such as (i) extensive soil conservation measures in the catchment area of the tributaries, and (ii) construction of storage reservoirs for trapping the coarser silt are suggested, and mention is made of the construction work already in progress for implementing the above steps.

Design of Anchored Bulkheads

V. N. S. Murthy
Associate Member

The paper presents a set of curves for the design of anchored sheet pile walls. The curves give the free earth support values for uniform surcharge and any level of water in the dredge channel for four positions of the anchor rod. The curves apply to fill bulkheads with clean loose sand deposited above the dredge channel, and loose, medium or dense sand in place below the channel. The paper explains how these curves can be used for any density of sand below the channel and how the free earth support values so obtained may be modified to satisfy the field conditions and the experimental investigations of Rowe on the relationship between bending moment and flexural rigidity of piles.

STRUCTURES GROUP—2 SHELL STRUCTURES

Analysis of Edge Disturbances in Circular Cylindrical Shells*

S. K. Mallick
Non-member
S. Singh
Non-member
and
P. C. Bhargava
Non-member

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* Summary of this paper was published in the July 1962 issue of the *Bulletin*.

Criteria for the Selection of Edge Beam Dimensions for Long Cylindrical Shells

G. S. Ramaswamy
Member

M. Ramaiah
Non-member

and

S. S. Bedi
Student

The authors have studied the effect of varying the edge beam depth on the stresses in a shell, keeping the other parameters constant. The depth of the edge beam is considered to be the most important parameter governing the total depth of the shell as the semi-central angle does not vary much in practice. This study aims at arriving at the optimum depth of edge beams for long cylindrical shells. The rules enumerated, it is stated, will help to eliminate the need for trial calculations with a number of edge beams of different sizes.

Analysis of Prestressed Prismatic Shells

M. G. Tamhankar
Non-member

An approach to the analysis of prestressed prismatic shells is described in this paper. It is shown that this approach is also applicable to cylindrical shells by approximating them as folded plates. The stress distribution technique of Simpson has been used to find the stress caused by prestressing in the plates, and to arrive at the optimum prestressing force, a criterion is derived. The influence of variation of the prestressing force on the stress resultants in a prestressed shell is described.

ROADS & ROAD TRANSPORTATION GROUP

Traffic Accidents and Their Specific Problem in Assam—1

G. C. Sharma
Member

The first part of the paper describes the general trends of growth in population, construction of road mileages, and motor vehicle industries and their manufacturing capacities in our country now and in the future; and gives a comparison of (i) accident rates and population, and (ii) road mileage and number of motor vehicles. It indicates in their second part of the paper the major elements in road traffic accidents and their causes and the recommendations for safety measures in respect of Assam. Finally, it outlines the problems for future studies and suggests remedial measures for prevention of traffic accidents.

MECHANICAL ENGINEERING DIVISION

Trends in Manufacturing Processes and Design of Machine Tools—A Challenge to Production Management*

S. K. Basu
Associate Member
and
R. Mishra
Member

The machine tool industry has just made a start in our country and a great responsibility lies on it in the task of designing and machine building for the country's needs. Technologies have been changing fast, and the erstwhile concepts of production rate, parameters of machinability, quality and output are being rendered obsolete almost incessantly with the advent of newer materials and machines and techniques. It is stressed that good management and a manager equipped to face these challenges are an essential for industrial success.

Investigations on a Radial Drilling Machine

P. K. Chakraborty
Non-member
and
S. K. Basu
Associate Member

In this paper, the authors have measured the thrusts and torques resulting from a drilling operation and have obtained the magnitude of the deflections suffered by the various members of a radial arm drilling machine by applying static loads through the drill spindle. The instrumentation consists of a mechanical dynamometer for measuring the drill thrust and torque simultaneously and an adjustable universal tubular frame for measuring the absolute values of deflections. The authors have also found out the overall statical rigidity of the radial drilling machine. The complete set-up was fabricated by the authors.

Investigation on Bladeless Nozzle Apparatus of the Radial Flow Turbine

A. V. Gubarev
Non-member
G. A. Philippov
Non-member
L. Y. Lazarev
Non-member
and
A. D. Pandya
Associate Member

The paper describes the investigational work carried out to determine the efficiency of a bladeless-nozzle apparatus which possesses definite advantages when used in radial flow turbine practice. Though the design techniques have made possible highly efficient blade apparatus for the purpose, the blade apparatus poses difficulties such as in orienting the flow at the entrance to the blades, fixing the dimensions of the collector ring, and manufacture of the blade apparatus. An elementary design method is described here for the bladeless nozzle apparatus which permits with sufficient accuracy the adoption of dimensions which are important from the point of view of the reverse problem and the problem of variable regime.

Use of Availability of Work-Enthalpy (*B-I*) Diagram for Efficiency Calculation of Freon Refrigerating Machines

L. Z. Melster

Non-member

and

R. V. Srinivasan

Non-member

The difficulty of using the coefficient of performance as a standard for comparing refrigerating machines working between different temperatues of condensation and evaporation is well known, and the necessity for taking into consideration only the work availability of different forms of energy entering and leaving a machine for evaluating the true efficiency of thermal and refrigerating plants has been pointed out by Keenan and others. While it is comparatively easy to find the work availability of heat energy, it is laborious to calculate the work availability of the working substance at various state conditions.

The diagram constructed by the authors can be used for finding the availability of work of Freon-12 for temperatures of the atmosphere from 15° to 40° C. For this purpose, a series of correction curves are supplied separately below the diagram. The theoretical basis on which the construction of these correction curves was possible is also described. A practical illustration is given of the method of finding the value of *B* for a given state of the refrigerant when the atmospheric temperatures are 20° and 35° C.

The cycle of a single stage compression refrigerating machine is represented in the *B-I* diagram, and the method of calculating the degree of reversibility or perfection of the machine as a whole or of each of the processes, *viz.*, compression, condensation, expansion and evaporation, is also explained. The diagram enables a true comparison of the working of Freon-12 refrigerating machine under different conditions.

What Goes on in a Welding Arc

R. C. Mitra

Non-member

The arc in arc welding, with a consumable or non-consumable electrode, and a dissociable or non-dissociable inert gas used as envelope, is an electrical discharge from the anode to the cathode through a conductive (ionised) gaseous (plasma) medium.

In welding, the arc is the most important as a source of heat for the chemico-metallurgical reactions and for the metal transfer that takes place through it. Other factors involved are the pattern of gas flow, temperature distribution along the length of the arc, the reacting gases, the metal to be welded and the forces acting. The environmental condition in actual welding being different than under experimental conditions, investigations carried out up-to-date appear to be incomplete, though they throw plenty of light on the subject.

ELECTRONICS & TELECOMMUNICATION ENGINEERING DIVISION

Simulation of Third Order Systems with One Operation Amplifier

G. K. Aggarwal
Non-member

and

L. K. Wadhwa
Non-member

This is an extension of the work reported earlier by Wadhwa. The paper presents a variation of one of the six basic circuits discussed in the earlier communications. It shows that the spectrum of physically realizability conditions can be widened and made more continuous and the possibility of simulation of any particular system can be increased.

Telegraph Codes for the Phonetic English Alphabet

S. Balaram Rao
Associate Member

and

S. Raghunatha Rao
Non-member

Telegraph codes for the phonetic English alphabet are proposed in this paper. Three alternatives for the Morse code and two alternatives for the teleprinter code are indicated. The first two alternatives for the Morse code are based on minimization of channel time and ease of operation respectively. A combined consideration of the foregoing factors leads to the third alternative, a factor designated 'Durel' being defined for the Morse signal for each letter. The two teleprinter codes are based on the 5-unit three-shift system and the 6-unit two-shift system respectively. The relative merits of the two systems are referred to and the relative speeds of transmission estimated.

Design and Fabrication of a Cavity to Measure Complex Permittivity at X-Band

M. Chaudhuri
Non-member
and
O. P. N. Calla
Non-member

Dielectrics are important substances in connection with electromagnetic energy transmission or storage. The dielectric properties of gases at high pressure and of liquids and solids are still known quantitatively only in rough outlines from molecular theories, and so measurements of the properties are indispensable. In view of the samples being of disc shapes, the resonant cavity method had to be adopted for measurements. A tunable cylindrical cavity to sustain the proper mode (H_{011}) having the effects of the unwanted modes minimized, was designed and fabricated. The results were found to be within reasonable limits of accuracy. As it often happens that the loss due to the dielectric is small compared with the loss due to the metal of the cavity, one is in the unfavourable position of measuring a small quantity in the presence of larger parasitic ones.

One Operational Amplifier Simulates Third Order Systems with Simple Lead

L. K. Wadhwa
Non-member

The paper outlines a method for the simulation of third order systems with only one operational amplifier. A particular case of the general third order systems, *i.e.*, systems with simple lead, is considered in this paper. A network consisting of one operational amplifier, three capacitors and five resistors is presented, and the conditions under which it can simulate the given system are discussed. The validity conditions and the design procedure are also dealt with.

HINDI SECTION

Building Construction in the Soviet Union by Cubical Block Elements

J. Jha
Non-member
and
B. Sahay
Non-member

The paper presents a brief survey of the most recent methods of building construction in the U.S.S.R. In view of the colossal targets of residential housing during the

present Seven Year Plan (1959-65), the methods of building construction and production of building materials had to be revolutionized. The paper gives a brief description of the methods of production, transportation and assembly of elements and a short theoretical background of architectural composition in making up large flat blocks. The limitations and uses of caterpillar cranes, derrick cranes and tower cranes for construction work are described and the uses of helicopters and jacks are mentioned.

Importance of Cascade Analysis in the Design of Axial Flow Compressor Blades

C. B. Misra

Non-member

The design of an axial flow machine is complicated. A number of solutions to this problem have been found by the author based on several studies. This paper explains some important methods of design, and the theoretical and practical aspects of cascade action. Correlation is explained on the basis of 'nominal work' as well as 'optimum condition' of Carter. An analysis is also made of the methods of NACA cascade research. The necessity of improving cascade data for use in the design of actual machines is considered. The necessary improvements in cascade data and three-dimensional loss are discussed.

Engineering Mechanics—Statics

B. N. Thadani

Associate Member

This is the third and concluding part of the paper on the subject of engineering mechanics and deals with statics.

Ali Mardan Khan—an Eminent Moghul Engineer

J. K. Varshneya

Non-member

Ali Marden Khan was the Governor of Kandahar of Kurdish extraction, as well as an able engineer. To save his life from the intrigues at the court of the Shah of Persia, he presented himself before Shahjehan, the Emperor of India, at Lahore. Appreciating his abilities as an administrator and an engineer, Shahjehan made him a Commander of 6,000 horses and appointed him Governor of Punjab and later Governor of Kashmir. He designed and constructed the western Jumna canal and the eastern Jumna Canal from Tajewala on the Jumna and thus brought the canal water to the Red Fort at Delhi. In Punjab, he constructed the Ram canal and laid out the Shalimar gardens at Lahore. He is said to have designed the large dome of the Taj Mahal at Agra.

The English Channel-Tunnel

J. K. Varshneya

Non-member

For the last 160 years, engineers, politicians and generals in Britain and France have been thinking of connecting the two countries by a tunnel under the English Channel, separating these countries. This paper outlines the historical development of the concepts of the channel-tunnel up to the present time and lists the various schemes that have been put forward so far. As Britain is going to join the European Common Market, the prospects of this project materializing have now become brighter.

Valuation of Immovable Property

Vishwambhar Prasad

Associate Member

The article deals with methods of engineering valuation of immovable properties. Valuation being not a science, the aim is to come to a satisfactory decision about the reasonable amount that can be paid for a particular property. It is a matter more of judgment than of calculation. The valuer has therefore to study the problem from all angles, and should be possessed of a variety of information and data so that his judgment may not have to be restricted to a few considerations only. Data which have to be systematically compiled are indicated.

Various methods for calculation of the reproduction cost of a structure are described and practical hints suggested. Calculation of depreciation taking into account the factors causing loss of functional utility are explained, giving suitable forms and tables for working out the present value with reference to the age of the structure.

A property as a source of income should fetch a reasonable return on the amount invested. Formulæ for calculating the present worth, the sinking fund, etc. are derived and the use of annuity tables is briefly explained, so that if the market rent which the structure is likely to fetch is known, it can be capitalized to give the present value of the investment.

INSTITUTION NOTICES

Postponement of the 43rd Annual Convention, Bangalore, February 1963

Attention of members is invited to the notice published on page 14 of the December 1962 issue of the *Bulletin* wherein it was stated that the new dates of the Annual Convention will be decided by the Council at a meeting which will be held late in January 1963. So far the meeting of the Council has not been held, and in the circumstance, further information on the programme of the Convention will be made available after it receives the attention of the Council.

Proposed Upgrading of the Public Health Engineering Group to the Status of a Division

Attention of members is invited to the notice published on page 14 of the November 1962 issue of the *Bulletin* with regard to the proposed upgrading of the Public Health Engineering Group to the status of a Division and the card for 'Requisition for Attachment in the Proposed Public Health Engineering Division' attached to the above *Bulletin*. Since the Chairman of the Public Health Engineering Group now feels that the card attached to the above *Bulletin* would not get adequate response from members particularly as it is indicated that those names which may be transferred to the proposed Public Health Engineering Division would be deleted from the present Civil Engineering Division; and that though correspondence and personal contact with members interested in the formation of this Division would ensure signatures of more than 500 members, they would involve long procedure which is hardly possible, he desires that the card be withdrawn from circulation.

The card may therefore be treated as cancelled and need not be returned to this office.

The matter has been placed before the President who has been authorized by the Council to raise the Public Health Engineering Group to the status of a Division, according to the Resolution of the Council, already announced in the above *Bulletin*.

Transactions of the Sixth Plenary Meeting of the World Power Conference, Melbourne, October 20-27, 1962

The Sixth Plenary Meeting of the World Power Conference was held in Melbourne from October 20-27, 1962, and was attended by eminent engineers, scientists, industrialists and administrators. The theme for the meeting was 'The Changing Pattern of Power', chosen to enable an analysis to be made of the changes currently taking place in energy exploration, production, transformation, transportation and utilization techniques, and an economic evaluation to be made of alternative energy sources, whether primary or secondary. As this was a Plenary Meeting, a survey of world energy resources was also made, being based on the World Power Conference Survey of Energy Resources, 1962, and on surveys prepared by National Committees dealing on broad lines with developments in the exploitation and use of all primary sources of energy during a period of six years prior to the meeting, together with forecasts of demands for each form of energy for each of the years 1965 and 1970, and where possible, also for the years 1975 and 1980.

The Institution continues to act as the Indian National Committee for the World Power Conference. Prof. M. V. Deshpande (*M.*), Chairman, Electrical Engineering Division, led the delegation from the Indian National Committee and presided over the Sub-Division IV.3—Utilization of Primary and Secondary Energy (Transportation), of the meeting. The other two delegates from India were Shri S. Swayambu (*M.*), Director, Power Research Institute, Banjalore, and Shri M. Dayal, Senior Design Engineer, Tarapore Atomic Power Project, Department of Atomic Energy, Bombay.

The Transactions of the meeting are being published by the Australian National Committee in 14 volumes, the first 10 of which include a total of 208 technical papers printed in either English or French, according to the choice of the author, with a summary in both languages. The papers in each of the sub-divisions will be preceded by a General Report, printed in either English or French. The text of the three General Addresses presented at the meeting will also be printed in Volume 12. Volume 13 will contain a chronicle of the meeting and Volume 14 an index of the Transactions. It is anticipated that Volumes 1 to 13 will be published about April 30, 1963.

The pre-publication price is £60 (Australian currency), on orders received by the Australian National Committee prior to April 30, 1963. The publication price is £65 (Australian currency). These prices include postage by surface mail. Though the Institution, as the Indian National Committee of the World Power Conference, reserves the sole selling right of these Transactions, due to restrictions on foreign exchange, no order is received by the Institution. Those desirous of purchasing may place their order directly with the Australian National Committee, World Power Conference, 2nd Floor, V.C.A. Building, 1 Collins Place, Melbourne, C. 1, Victoria, Australia, under advice to the Institution.

Application forms for Sections A and B of the Associate Membership Examination to be held in May 1963

Application forms for Sections A and B of the Associate Membership Examination (existing scheme) to be held in May 1963 are attached to this issue of the *Bulletin*. The programme of the examinations and the detailed instructions are also attached with the application forms, and they may be detached for reference, if so desired. All these forms, the programme of examinations and the detailed instructions are **printed on white paper** to distinguish them from those applicable to the new scheme which are printed on pink paper. Students are notified that no further application forms will be distributed to them.

Applications complete in all respects and accompanied by examination fees for admission to the May 1963 examinations and two copies of passport size photograph pasted in the spaces provided on the application form should reach the Head Office before 4.00 p.m. on Friday, March 15, 1963.

New scheme for Sections A and B of the Associate Membership Examination to be held in May 1963

Application forms for Sections A and B of the Associate Membership Examination (new scheme) to be held in May 1963 (**printed on pink paper**) are attached to this issue of the *Bulletin*. The programme of the examinations and the detailed instructions (**printed on pink paper**) are also attached with the application forms and they may be detached for reference, if so desired. Students are notified that no further application forms will be distributed to them.

Applications complete in all respects and accompanied by examination fees for admission to the May 1963 examinations (new scheme) and two copies of passport size photograph pasted in the spaces provided on the application form, should reach the Head Office before 4.00 p.m. on Friday, March 15, 1963.

New Indian Standards Issued

The following new Indian Standard Specifications have been issued.

Two Revised Indian Standard Specifications for (a) Liquid Driers for Paints (IS : 385), and (b) Liquid Driers, Concentrated, for Paints (IS : 386), prescribing the requirements and methods of test for liquid driers, and liquid driers, concentrated, for paints.

Indian Standard Specification for Ready Mixed Paint, Stoving, Red Oxide-Zinc Chrome, Priming (IS : 2075-1962), prescribing the requirements and methods of test for the materials commercially known as ready mixed paint, stoving, red oxide-zinc chrome, priming, for the protection of steelwork.

Indian Standard Specification for Ready Mixed Paint, Brushing, Zinc Chrome, Priming, for Use on Aluminium and Light Alloys (IS : 104-1962), prescribing the requirements and methods of test for the material commercially known as ready mixed paint, brushing, zinc chrome, priming, for use on Aluminium and light alloys.

Indian Standard Specification for Bottle Coolers (IS : 2167-1962), dealing with the general constructional requirements, and methods for establishing ratings and testing of bottle coolers operated by vapour compression type refrigerating machines.

Indian Standard Specification for Reinforced Concrete Dust Bins (IS : 2174-1962), dealing with both cast *in situ* and precast reinforced concrete dust bins.

Indian Standard Specification for Timber for Lorry Bodies (IS : 2179-1962), dealing with timber species suitable for lorry bodies and the requirements of such timber in converted form.

Indian Standard Specification for Structural Steel (Ordinary Quality) (IS : 1977-1962), dealing with two grades of steel, for general purposes such as door and window frames, window bars, grills, steel gates, hand railing, builders' hardware, fencing posts, tie bars, etc., and for structures not subject to dynamic loading other than wind loads, as, for example, platform roofs, foot over bridges, office buildings, some members of transmission towers, other ordinary factor sheds not subject to dynamic loading.

Indian Standard Specification for Structural Steel (High Tensile) (IS : 961-1962), dealing with the requirements for high tensile steel use in structural work.

These Standards are available from the office of the Indian Standards Institution 9 Mathura Road, New Delhi, or from its branch offices at Bombay, Calcutta, Kanpur and Madras.

Address wanted

The mails of the following members have been returned undelivered. Any member in a position to assist the Headquarters with their present addresses is requested to do so.

AM 10700 Ramaswami Anantha,
11 T.S. Flats, B.H. Area, Jamshedpur 5.

S 37480 Bimal Kanti Ray,
House of Shri Parkash Chandra Sarkar, Chunariapara Kanthadar, P.O. Ichapur-Nawabganj, West Bengal.

S 37951 Bomma Subbarami Reddy,
14 Ramachandraiyer Street, T'nagar, Madras 17.

S 38049 M. Jayabalachandran,
c/o Madras College of Engineering, 97 Swami Naicken Street, Madras 17.

S 39702 G. D. Deshpande,
Overseer, Soil Survey Camp, 4/46 I.L.H. Colony, Nanded, Maharashtra.

S 39705 Suchayan Dasgupta,
P 109 Becharam Chatterjee Road, Behala, Calcutta 34.

INSTITUTION NEWS

The Engineering Institutions Joint Council

The Engineering Institutions Joint Council has been set up by Britain's leading bodies of professional engineers, with a combined membership of over 200,000, to work more closely, under the Chairmanship of Sir Kenneth Hague. The bodies represented on the Council are : (i) The Royal Aeronautical Society, (ii) The Institution of Chemical Engineers, (iii) The Institution of Civil Engineers, (iv) The Institution of Electrical Engineers, (v) The Institution of Gas Engineers, (vi) The Institute of Marine Engineers, (vii) The Institution of Mechanical Engineers, (viii) The Institution of Mining Engineers, (ix) The Institution of Mining and Metallurgy, (x) The Institution of Municipal Engineers, (xi) The Institution of Production Engineers, (xii) The British Institution of Radio Engineers, and (xiii) The Institution of Structural Engineers.

The purpose of the Joint Council is to enable representatives of the bodies concerned to meet together to consider and take action upon matters of common interest relating to the advancement of engineering and dissemination of knowledge in that field. It also aims to establish a sound and useful channel of communication and understanding between the professional engineers, the Government, the public, and national and international bodies concerned with engineering.

The Joint Council has appointed Mr. K. H. Platt as Honorary Secretary, and it will have its office in The Institution of Mechanical Engineers, 1 Birdcage Walk, Westminster, London, S.W.I.

FORTHCOMING CONFERENCES

U.N. Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas, Geneva, February 4-20, 1963

One of the biggest ever organized by the United Nations, the Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas, will be held in Geneva between February 4-20, 1963, to grapple with urgent problems of the economic growth of less developed areas. The aim of the Conference is to bring to light practical means by which less developed areas can save time and money in realizing their development plans. Dr. M. S. Thacker, Member, Planning Commission, Government of India, a past-President of the Institution, will be the President of the Conference and Prof. Carlos Chagas (Brazil), its Secretary-General. It is expected that some 1,500 leading scientists and technologists from all over the world will attend the Conference. The delegation from India will consist of Dr. H. J. Bhabha, Secretary, Department of Atomic Energy, Government of India; Dr. M. S. Randhawa, Adviser (Resources), Planning Commission; Dr. S. H. Zaheer, Director-General, Council of Scientific and Industrial Research; Dr. V. K. R. V. Rao, Director, Institute of Economic Growth, University of Delhi; Dr. S. R. Sen, Joint Secretary, Planning Commission; Shri J. R. D. Tata, Chairman, Air India International; and Shri A. S. Mehta, Permanent Representative of India to the European Office of the United Nations in Geneva.

Health Congress, Eastbourne, April 29 to May 3, 1963

The next Health Congress will be held in Eastbourne, Sussex, England, from April 29 to May 3, 1963, under the auspices of The Royal Society (for the promotion) of Health. Many subjects of international interest will be included in the programme of technical meetings and conferences arranged in the several sections of the Congress. In the Radiation Section, there will be a symposium on 'Levels of Radiation in Air, Water and Food, and Their Significance'. The World Health Sections will discuss 'Child Health: the World Situation'. Many of the other subjects to be discussed at the Congress will include international aspects of meat hygiene, noise nuisances, health aspects of food distribution, and chronic bronchitis and occupation. Prof. A. B. Semple, Chairman-Elect of the Council of the Society will open the Congress and Prof. Ritchie Calder, the Guest Speaker, will address the Congress on 'Public Health in the Space Age'.

The Health Exhibition to be held in conjunction with the Congress, an important feature of the Congress, will enable delegates to see, at first hand, the latest equipment and products of many leading manufacturers as well as displays by Government departments and trade and research organizations. There will be visits to various housing schemes, hospitals and clinics, special schools, catering establishments, and water and other public undertakings.

Attendance at the Health Congress will be of interest to public health workers and students visiting the U.K. on study tours or travelling scholarships. A volume containing the proceedings of the Congress will also be published.

Further details of the Congress can be obtained from the Secretary, The Royal Society of Health, 90 Buckingham Palace Road, London, S.W. 1.

International Telemetering Conference, London, September 23, 1963

The first International Telemetering Conference, sponsored by the American Institute of Electrical Engineers, the American Rocket Society, the Institute of Aerospace Sciences, the Institute of Radio Engineers, the Instrument Society of America, the British Institution of Radio Engineers, and the Institution of Electrical Engineers, will be held during the week beginning September 23, 1963, at the Institution of Electrical Engineers, London. Although this is the first international conference on the subject of telemetering, it follows directly a series of annual National Telemetering Conferences held in the United States over the past several years, and is being held in London at the suggestion of the five American sponsoring societies.

The Conference will cover the following aspects of telemetering : (i) characteristics of the information to be telemetered, (ii) transducers, (iii) signal conditioning (pre-transmission), (iv) transmitting systems (including coding), (v) receiving and recording systems, (vi) signal recovery (demodulation), and (vii) data reduction, presentation and evaluation (but excluding computers, except as incidental to the foregoing).

Papers for the Conference, limited to a maximum of 4,000 words, should be submitted in full manuscript (three copies) by March 1, 1963, to the Secretary, The Institution of Electrical Engineers, Savoy Place, London, W.C. 2. Further details regarding the Conference and registration may be obtained from him.

Arrangements are being made for an Exhibition of Telemetering Equipment to be held in London during the Conference. Enquiries relating to exhibits should also be addressed to the Secretary, The Institution of Electrical Engineers, London, W.C. 2.

BOOK ACKNOWLEDGMENTS

1. **Elemente Pentru Calculul Placilor Curbe Subtiri Elastice.** V. Visarion. *Editura Academiei Republicii Populare*, Romine. 384 pages.

This book (written in Rumanian) on elastic thin shells is intended for civil and mechanical engineers and technicians working on the design of thin shells as well as for research workers. It presents results obtained in Rumania by using methods which extend some of the most recent and valuable results of the Soviet school of investigators in the domain of the theory of thin shells. The first chapters, devoted to the general theory, present the theory of the quasi-invariants of the statical-geometrical analogy, on the basis of the statical-geometrical analogy and the extension of the complex forces. On the same basis, the quasi-invariant models of the 'membraneless shell' and 'momentless shell' are constructed. A general method of solution is developed which, without employing a particular mathematical instrument, gives by elementary operations the possibility of approaching the calculation of any shell. Most of the calculation methods deduced in this book are conceived under Mushtari-Vlasov's assumption of shallow shells which covers many practical cases met with. Some results specific to the mathematical problems intervening in the theory of elastic thin shells are given. Indications pertaining to the dynamic calculation of thin shells and orthotropic shells are also given. The results are applied to the dynamic calculation of motor vehicle bodies, proving thus the possibility and the manner of applying the theory of plates to the calculation of thin shells.

2. **Purer Metals.** Published for the Institution of Metallurgists. *Iliffe Books Ltd.*, 35s. 113 pages.

This book comprises of four papers the first of which discusses the removal of gaseous impurities by various processes : vacuum degassing to remove hydrogen from liquid steel, and vacuum refining used in the manufacture of nickel base Nimonic alloys to eliminate other volatile impurities such as lead. The relative merits of the vacuum induction melting and consumable arc processes are weighed and it is proposed that the electron beam process overcomes the inherent disadvantages of the above methods. The second paper traces the preparation of pure metals from an earlier stage. The subsequent refining by distillation, zone refining, the Van Arkel process and vacuum treatment are dealt with. The third paper shows how minute quantities of added trace elements can produce dramatic changes in such fundamental properties of metals as lattice binding, electron mobility, mobility of atoms and point defects, movement of dislocations, mobility of grain boundaries and nucleation of phases, and in the chemical properties. The fourth paper discusses the properties of and demand for purer metals. The considerable advance in the last 30 years in quantitative and qualitative analysis of trace elements, the effect of impurities on the mechanical, chemical, electrical, magnetic and nuclear properties of metals, and the importance of purer metals in various manufacturing processes and in aeronautical, nuclear and electronic engineering are discussed.

LIST OF NEW ELECTIONS AND TRANSFERS

(*Continued from Bulletin for August* 1962)

STUDENTS

No.	Name
33001	Amiya Kumar Pain
33002	Natesa Nanjayyan
33003	Yash Pal Kakar
33004	Ravindra Hari Tamotia
33005	Pokala Lokanathan
33006	Pranab Kumar Roy Chowdhury
33007	Ramesh Gobindram Sonpar
33008	Purushottam Gupta
33009	Vasudev Anandas Sawlani
33010	Anil Kumar Sen
33011	Tarapada Ballav
33012	Jagdish Prasad Sinha
33013	H. N. Srinivasa Murthy
33014	Biplab Kumar Basu
33015	Mukul Ranjan Saha
33016	Mahanth Prasad Shrivastava
33017	Raghav Lal
33018	Baidyanath Rudra
33019	Rathindra Nath Roy
33020	Sudhansu Sekhar Barui
33021	Malay Kumar Kar
33022	Arun Kumar Hazra
33023	Bijay Kumar Malakar
33024	Braja Ranjan Mazumder
33025	Gunadhar Pal
33026	Pranab Kumar Basu
33027	Om Prakash Mehta
33028	Baijnath Ramdayal Parashar
33029	Yogindra Singh Pundhir
33030	Lakshman Chandra Santra
33031	Basudev Bhattacherjee
33032	Manabendra Nath Sarkar
33033	Dilip Kumar Mukhopadhyay
33034	Amiya Kumar Das Gupta
33035	Benoy Krishna Sarker
33036	Chiraranjan Bhattacharyya
33037	Bhupendra Nath Panti
33038	Tusar Kanti Bose
33039	Amnath Baig
33040	Galiapet Srirangachariar Krishnaswami
33041	K. B. Chandramohanan Nair
33042	Kakumani Umamaheswar Rao
33043	Murikipudi Sarveswara Sarma
33044	G. R. Pillai
33045	Golla Munikrishnudu
33046	Nimmagadda Purna Prabhakara Rao
33047	M. Padmanabhan Muralidharan
33048	Behara Sundara Rao
33049	Chebolu Venkata Narasimha Rao
33050	Nakkala Radhakrishnamurthy
33051	Ramaswami Nagarajan
33052	Kailash Nath Agrawal
33053	Dipes Narayan Ray
33054	Kutubuddin Ahmed
33055	Buddhadeb Roy
33056	Rathindra Nath Sinha
33057	Pindiprolu Satyanarayana Murty
33058	Sanat Kumar Chakraborti
33059	Chilakapati Veeraraghavacharyulu
33060	M. Narasimha Rai
33061	Yadavalli Venkatasivudu
33062	Sujit Kumar Sarkar
33063	Bibhu Ranjan Mukhopadhyay
33064	Tapan Kumar Chakraborty
33065	Tarak Nath Dey
33066	Nirmal Kumar Rudra
33067	Nityabenode Bandyopadhyaya
33068	Rabin Chanda
33069	Krishna Chandra Naiya
33070	Nittoor Subba Rao
33071	Pathrose Gerard
33072	Mutchini Kodanda Rao
33073	Padmanabhan Sivadasan
33074	Malayalaramaswamy Chandrahasan
33075	Gopalan Swaminathan
33076	Vilacheri Natarajan Suriyanarayanan
33077	A. P. Thiruvengadam
33078	Shambhu Nath Bandyopadhyay
33079	Samir Kumar Gupta
33080	Nikhil Ranjan Pradhan
33081	A. C. Baboo Ram Misra
33082	Laxman Prasad Saxena
33083	Prasanta Kumar Ghosh
33084	Ashis Kumar Banerjee

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No.	Name	No.	Name
33085	Pijush Kanti Ghosh	33130	Jagadish Chandra Ghosh
33086	Om Prakash Pandya	33131	Jyotirmoy Sen
33087	Pradosh Kumar Nath	33132	Hardial Singh Garcha
33088	Tapan Kumar Das	33133	Shailendra Kumar Jain
33089	Gouri Sankar Bolel	33134	Rajiye Nain Prasad
33090	Subhash Chandra Aich	33135	Gian Chand
33091	Ajit Kumar Mukherjee	33136	Ramanup Ram
33092	Sudhir Kumar Pramanik	33137	Dendukuri Sreeramachandramurthy
33093	Partha Pratim Chatterjee	33138	Suresh Chandra
33094	Somen Kumar Dutta	33139	Satish Chandra Agarwal
33095	Tapan Kumar Bhattacharyya	33140	Satish Kumar Sood
33096	Parmatma Swarup Bhatnagar	33141	Leyaqat Ali Khan
33097	Fg. Off. Prem Datt Bali	33142	Sridam Chandra Saha
33098	Hanumaiah Narasimhaiah	33143	Babu Lal Agrawal
33099	Bhimasen Govindrao Wadawadgi	33144	Bindiganavole Krishnaiyengar Srinath
33100	N. S. Shivaram	33145	Shyam Lal Aggarwal
33101	Balvindar Singh Sidhu	33146	Suraj Nath Srivastava
33102	Manohar Lal Joshi	33147	Sheo Nath Tangri
33103	Virendra Kumar Saxena	33148	Kashinath Vishnu Kulkarni
33104	Krishna Kant Pandeya	33149	Balraj Singh
33105	Ramji Misra	33150	Kuldip Singh Toor
33106	Gurdev Singh	33151	Sankarapillai Padmanabha Pillai
33107	Narinder Singh Bajaj	33152	Babu Lal Singh
33108	Ratnesh Kumar	33153	Atindra Nath Gangopadhyay
33109	Ram Krishan	33154	Ajit Chandra Kumar
33110	Tarun Lal Dhar	33155	Atmaling Pandappa Angadi
33111	Krishna-Chandra Singh Yadava	33156	Bishan Singh Sethi
33112	Krishnadeo Prasad	33157	Jagan Nath Juneja
33113	Sushanta Kumar Das	33158	Bhoj Raj Garg
33114	Madan Mohan Singh	33159	Krishan Lall
33115	Prayag Chand Singhvi	33160	Vedagiri Ramaswamy Chetty
33116	Shashi Prakash Bhatnagar	33161	Krishnamurthy Subramanian
33117	Mahesh Chandra Nigam	33162	Arumuganadar Chandrasekaran
33118	Raj Kishore	33163	Ramanujam Thiruvenkatachari
33119	Jugal Kishore Vyas	33164	Thiruvengadasamy Ananda Krishan
33120	S. P. Chettiar Devandran	33165	Rama Kant Jha
33121	Sivanna Sreekantaswamy	33166	Jagdish Lal Gera
33122	Ranvir Singh Verma	33167	Amir Singh Sangwan
33123	Murari Chakraborty	33168	Bal Krishna Kumar
33124	Sitaram Sah	33169	Sunil Dutta
33125	Harbansh Lal Arora	33170	Bagala Charan Chakraborty
33126	Roop Krishan Sharma	33171	Surjit Singh Makar
33127	Satish Chandra Saxena	33172	Joginder Singh Grewal
33128	Yoginder Pal Bagaie	33173	Pritam Lal Kapur
33129	Baldeo Prasad Singh	33174	Ombadamkuni Puthiyapurayil Ravindran

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No.	Name	No.	Name
33175	Parmanand Karan	33220	Murlidhar Lalchand Virwani
33176	Mohammed Amin	33221	Doulat Santumal Kishinani
33177	Sat Dev Sharma	33222	Kanhiyalal Khatri
33178	Ranipet M. Chandra Muthu	33223	Kailash Narayan Tanwar
33179	Eapen Thomas	33224	Satish Chander Sawhney
33180	Marimuthu Kaliappa Theivasigamani	33225	Kishanlal Rathi
33181	Thoppey Ramalingam Balaraman	33226	Karminarayyn Ganganarayn Mathur
33182	Kalika Rai	33227	Chandra Mohan Saxena
33183	Anil Kumar Moitra	33228	Pramod Kumar Bhargava
33184	Narayan Prasad Poddar	33229	Joginder Singh Sahuja
33185	Mojindar Lakshmanarao Prahalada	33230	Gurnam Singh Gill
33186	P. Srinivasa Narayanan	33231	Lakshmi Narain Suri
33187	Franklin Norman	33232	Ashok Kumar Tewari
33188	Amrit Lal Jain	33233	Ved Parkash Mehta
33189	Srinivasiah Krishna Murthy	33234	Girish Chandra Agarwal
33190	T. N. Ramaswamy Iyengar	33235	Nachhattar Singh
33191	Bhagat Singh	33236	Amar Dev Tuteja
33192	Mariyappa Rudrappa Palled	33237	Nagar Ramachandra Balasubramanyam
33193	Uma Datt Kaushal	33238	Dev Raj Singla
33194	Narad Mohandass Assudani	33239	Sudarshan Kumar Suri
33195	Syed Ghazanfar Hussain	33240	Brijo Deoomal Purswani
33196	Sukeert Shantappa Hallu	33241	Surjeet Singh
33197	Shakti Dhar Sharma	33242	Bhagwan Dass Bhatia
33198	Basappa Anappa Sunagad	33243	Jagdish Singh Khokhar
33199	Kewal Krishan Bhandari	33244	Satyamangalam Nara simh asastri Nagarajan
33200	Mohinder Singh	33245	Biswaranjan Biswas
33201	Mohan Lal	33246	Uckoo Prahalad
33202	Hari Hassanand Shroff	33247	Cheemalakonda Atchyutarama Rao
33203	Anil Vinayak Gore	33248	Coca Raviprasad
33204	Rama Sharan Srivastava	33249	K. G. Ganapathy
33205	Lac Royyuru Gangadhara Sarma	33250	P. P. Varghese
33206	Debabrata Basu Roy	33251	Yudhvir Bakshi
33207	Korrapati Venkatanarayana	33252	Nand Lal Singla
33208	Hiren Chandra Chandra	33253	Vinodray Harilal Raval
33209	Kanayo Kishanchand Bulchandani	33254	Kokkanda Deviah Nanaya
33210	Narain Sunderdas Badlani	33255	Pranab Kumar Das
33211	Lachhman Gagumal Vanjani	33256	Gurdev Singh
33212	Gulab Hotchand Raisinghani	33257	N. Keshav Prasad
33213	Nanik Pessumal Raisinghani	33258	K. S. Srinivasan
33214	Narain Kalumal Nandwani	33259	Sohan Singh
33215	Veerendra Nandkishore Joshi	33260	Loganathachettiar Shanmugam
33216	Bal Kishan Mehra	33261	Dwarka Nath Bhatia
33217	Jawahar Sabhani	33262	Narendra Kumar Mittal
33218	Hanuman Singh Bhati	33263	Naresh Mohan
33219	Shanti Kumar Khanna	33264	Satish Chandra Saigal

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No.	Name
33265	Garani Sreenivasan Ramchandran
33266	S. Nagaraja
33267	R. S. Krishna Murthy
33268	G. K. Dwarakanath
33269	S. Kotresha
33270	Rameswamy Arunachalam
33271	S. S. Hazari
33272	K. Krishnamurthy Sethy
33273	P. Damodara
33274	Aurn Narahari Purandare
33275	Desh Bandhu Chopra
33276	Satish Gajanan Pradhan
33277	Prabhakar Keshav Kirpekar
33278	Koppula Sankara Rao
33279	Malyala Panduranga Rao
33280	Mahesh Chandra Sharma
33281	Veerachireddiar Kandaswamy
33282	Kalyana Sundaram Mohanbapu
33283	Chet Narayan Singh
33284	Bipinchandra Haridas Udeshi
33285	U. Ramesh Rao
33286	Nalavala Venkata Reddy
33287	Sokkappa Subramanian
33288	Mukund Rai Bhupatrai Dave
33289	Madhukar Chintaman Bam
33290	Sistla Gopalakrishnamurthy
33291	T. Thirumaleshwara Sharma
33292	Madan Mohan Lal Marwah
33293	H. V. Ananthapadmanabha Bhat
33294	Krishan Kumar Sehgal
33295	Tilak Raj Malik
33296	Krishna Rai Motwani
33297	Pritiram Shriram Lilhare
33298	Medepally Sitarameswamy
33299	T. Shanmugakani
33300	Gandavarapu Kotireddy
33301	Avtar Singh Randhawa
33302	Goli Reddiah
33303	Narindar Nath Chauhan
33304	Tadepaneni Lakshminarayana
33305	Sala Chandra Sekhara Rao
33306	Chinnaswamy Manivelu
33307	Muhammad Salahuddin Ahmed
33308	Devarapalli Mastan
33309	Nunna Radhakrishna Murty
33310	Vikram Bahadur Shrivastava
33311	Ayyalaraju Panduranga Rao
33312	Busi Frederick Henry Bhushanam
33313	Ram Roop Sharma
33314	Gope Dholandas Bellani
33315	Joginipalli Venketa Rama Rao
33316	Kirpal Singh
33317	Paka Venkataiah
33318	Desu Harinathayya
33319	S. C. Perumal
33320	Chadalavada Venkata Ramanaiah
33321	Sri Krishan Qazi
33322	Vishwambhar Modi
33323	Polapragada Satyanarayana Murty
33324	Ramesh Chandra Kumar
33325	Kishan Sarup Sharma
33326	Dondapati Chandrakesavulu Naidu
33327	Pritam Singh Bajwa
33328	Padmendu Mohan Biswas
33329	Akkala Ramachandra Prasad
33330	Braj Bhushan Gupta
33331	Lanka Venkata Rama Mohana Rao
33332	Setlur Rangaswamy Biligiri
33333	Alam Radhakrishna Naidu
33334	Om Prakash
33335	Chinnappolla Venkatappa
33336	Vadlamudi Sivarama Prasad
33337	Mohammed Afzaluddin Ansari
33338	Shamsuddin Malik
33339	Bachubhai Trikamlal Shah
33340	Bhagirath Bangarwal
33341	Lappasi Sundararajan Jeganathan
33342	Kailash Chandra
33343	Samakkulam Subramania Hariharan
33344	Sham Lal Sehgal
33345	Dhansukhlal Liladhar Joshi
33346	Bidhu Bhusana Panigrahi
33347	Makkapati Gurucharanam
33348	Manoranjan Das
33349	Pillutla Pardhasaradhi Sarma
33350	Ram Krishna Mahapatra
33351	Trabwan Prakash Naqab
33352	Mohini Mohan Rout
33353	Rajeshwar Dayal Singh
33354	Shailendra Kumar Ojha

STUDENTS (*contd.*)

No.	Name
33355	Pramod Kumar Kantha
33356	Bijoy Krishna Mahapatro
33357	Bhupinder Singh Kohli
33358	Shukdeo Barhi
33359	Digamber Deoram Shinde
33360	Kartar Singh
33361	Bandlapalle Aswarthanarayana Chetty
33362	Ram Saran Gupta
33363	Yeluri Narasimha Rao
33364	Gorla Nagi Reddy
33365	C. V. Gopalakrishnan Nair
33366	Gaddam Raj Reddy
33367	K. Y. Sri Rama Somayajulu
33368	Sridhar Ananthakrishnan
33369	Pattabiraman Hariswamy
33370	Laxman Anandrao Mode
33371	Ayalasomayajula Venkata Bhaskara Rao
33372	Ayalur Seshaiyer Kailasam
33373	Puttagunta Lakshminarayana
33374	Wazir Chand
33375	Om Prakash Vijaivargia
33376	Hebbar Krishna Sarma
33377	Sadashiv Dinkar Khanwalkar
33378	Noorul Hassan
33379	Rallapallai Anantha Padmanabha Sastry
33380	Malladi Balagopal
33381	P. N. Ramachandran
33382	Palivela Subbarayudu
33383	Chaman Singh
33384	Dharam Raj Roy
33385	S. K. Reddiar Chandrasekaran
33386	Upender Singh Milkhichand Sethi
33387	N. Rangaiyengar Srinivasa Rangan
33388	Mohammad Jalil
33389	Vallavdas Ranchhoddas Shah
33390	D. D. Sankara Lakshmi Narayana Sarma
33391	Jitendra Kumar
33392	Ram Raturi
33393	Gajanan Mahadeo Ganu
33394	Kondagula Venkataramaiah Seetharamu
33395	Raghuvansh Kumar Bhatia
33396	Surgonda Kalgonda Patil
33397	Laxmandas Kishinchand Bhojwani
33398	Madabhushi Srinivasiengar Seshadri
33399	Gopichand Sewakram Panjwani
33400	Jagdish Chander
33401	Vaitheeswaran Sambasivam
33402	Kanakam Lakshmipathy
33403	Durga Prasad Shukla
33404	Vasant Shripad Shende
33405	Iqbal Ashikli Khaliq
33406	E. R. Rajagopalan
33407	Gadiyaram Krishna Prakash
33408	Viswanathamudaliar Gnanasambandam
33409	Eswarakrishnaiyer Natarajan
33410	Govinda Raj Koushik
33411	Maddaly Ramababu
33412	Malayandyswamy Chettiar Thirumoorthy Swami
33413	Pattamangalam Rameswamy Madanagopalan
33414	Jagjit Singh
33415	Syed Maqdoom Mohiuddin Husaini
33416	G. Sivaramakrishnan
33417	Gopal Moreshwar Paranjpe
33418	Nahni Cawasji Sukhadwalla
33419	Bhimsen Chandiramani
33420	D. Sethuraman
33421	Kalluri Sree Ramulu
33422	Ramakrishna Sastry Seshamani
33423	Kasa Radhakrishnan
33424	Gustad Meherwan Irani
33425	Thodur Madaboosi Raghunathan
33426	K. V. Rajaraman
33427	N. Rajaraman
33428	Raymond Lawrence Albuquerque
33429	Gopadi Narayana Upadhyaya
33430	Mamdev Bhuvaji Arde
33431	Ravinder Kumar Madan
33432	Om Parkash Kalia
33433	Krishan Dev Khanna
33434	Inder Singh
33435	Sia Sharan Singh
33436	Mohamed Abdus Samad
33437	Pradip Kumar Sen Gupta
33438	Krishnaiyer Rathnam Krishnamurthi
33439	Nil Mani
33440	Devendra Kumar Puri
33441	Ramkrishna Narayan Khandekar
33442	Santosh Kumar Aggarwal

STUDENTS (*contd.*)

No.	Name
33443	Girdharlal Parbhatbhai Chotalia
33444	M. P. Manoharachandran
33445	Indradeo Sharma
33446	Bhagwat Persbad
33447	Amiya Sankar Bandyopadhyay
33448	Hari Singh Bhayana
33449	Bhupinder singh Kalra
33450	Musunuru Muralli Govrdhana Giri Rao
33451	Shyam Adhar Shrivastava
33452	Kambhampati Sitarama Sastry
33453	V. R. Balakrishna Rao
33454	M. Gokulnath
33455	N. R. Srinivasa
33456	R. Rajaram
33457	K. Shankara Sastry
33458	P. R. Krishna
33459	Bibhu Prasad Ghosh
33460	Basant Ram Dikshit
33461	Shankar Mangesh Kulkarny
33462	Gulshan Kumar Sahni
33463	K. Boraiah Shivalingaiah
33464	Pundi Rangaswamy Sundaram
33465	S. Albert Chinna Dorai
33466	Keshava Parvathavani
33467	Shreekant Mishra
33468	Agraharaanantanarayana Prabhakar
33469	Gopal Krishna Divekar
33470	Mangesh Shripad Dalvi
33471	Rajwant Singh Sethi
33472	Sisir Kumar Lahiri
33473	Murari Charan Dwivedi
33474	B. S. Narasimhan
33475	Rohini Kumar Das
33476	Assandas Lakhimal Mulchandani
33477	Yajaman Muddaveerappa Rajappa
33478	Gurubasappa Gangadharappa Halakatti
33479	Gutthalu Narasimhaiah Ramachandra
33480	Durga Shanker Nagda
33481	C. Natarajan Parathasarathy
33482	Subhash Anant Phadke
33483	Y. K. Swarnalingam
33484	Gulshan Rai
33485	Desaraju Rama Mohana Rao
33486	Surendra Kumar Singh
33487	Srikantaiah Rama Chandra Murthy
33488	Parma Nand Goel
33489	Prabhakar Shankar Deshpande
33490	Raghavendra Shreenivas Devale
33491	Narashimhamurty Hanumantarao Kusnur
33492	Sunder Dharamdas Merani
33493	Mohamed Khasim
33494	Ramachandra Chaturvedi Padmanabha Rao
33495	Shyamalendu Das Munshi
33496	P. K. Harikumara Panicker
33497	Mahinder Nath Sharma
33498	A. Rama Iyengar
33499	Ramesh Chandra Shantilal Garni
33500	Kul Bhushan Rai Kapur
33501	Santosh Kumar Sikdar
33502	Om Parkash Nagpal
33503	Somanath Dalai
33504	Avinash Kantilal Vora
33505	Ramesh Shivram Sohani
33506	K. N. Jayaram
33507	Rajendra Nath Bhargava
33508	Devineni Saratchandra Babu
33509	P. T. Joseph
33510	Anant Gunwant Nagarkar
33511	Suresh Chandra Satapathy
33512	Surandera Pal Singh Teothia
33513	Raj Mohan Srivastava
33514	Badri Narayan Ghosh
33515	Sawarn Singh
33516	Bhupendraprasad Prehladji Vyas
33517	Satya Pal Kohli
33518	Vasudev Krishan Bhatia
33519	Rajinder Nath Anand
33520	Kailash Bihari Srivastva
33521	Sudhir Balkrishna Karkhanis
33522	Harbans Singh
33523	Biswanath Sahu
33524	Ramchandra Sheshappa Dalal
33525	Naresh Chandra Kundu
33526	V. Harihara Iyer
33527	Ranganath Misra
33528	Rajendra Kumar Ghose
33529	Shripad Keshav Tambe
33530	Ikbal Husain Shaks
33531	Konda Satyanarayana Reddy
33532	Mehboob Abbas Shaikh

STUDENTS (*contd.*)

No.	Name
33533	Ramchandra Sitaram Gogte
33534	Biswa Nath Kundu
33535	Lal Bihari Sharma
33536	Madho Ram Arya
33537	Lingaraja Mohanty
33538	Rakhal Chandra Mohanty
33539	Somes Chandra Lahiri
33540	Banarasi Lal Sachdev
33541	Brajabandhu Lenka
33542	Rameshchandra Dhirubhai Naik
33543	Basudev Mahakul
33544	Ramarao Narayanrao Ugale
33545	Vinod Kumar Gupta
33546	Arumugham Thiagarajan
33547	Krishna Chandra Panda
33548	Vijayanand Narahari Nimkar
33549	Shankar Ramchandra Hoshing
33550	Bansidhar Sahoo
33551	Sat Ram Dass Jethani
33552	Tajinder Singh Gandhock
33553	Jitendra Kumar
33554	Devi Prasad Khanna
33555	Kamalakar Ramakant Bhangle
33556	Hari Vishnu Apte
33557	Vishwesh Ramchandra Ghaisas
33558	Keshavaiah Manjanathaiah
33559	Barun Kumar Dey
33560	Sharad Shamrao Patange
33561	Parminder Singh Bedi
33562	Mahendra Mohan Goswami
33563	Ravindra Nath Sinha
33564	Rameshchandra Dhirajlal Dubal
33565	Samir Kumar Mitra
33566	Prakash Champaklal Kotwal
33567	Vhagavatilal Durgashankar Dave
33568	Manohar Lal Wadhwa
33569	Balram Awasty
33570	Bishan Sahai Johari
33571	Amrit Lal Soni
33572	Pritam Singh
33573	Suresh Chand Gupta
33574	Yogendra Prakash
33575	Inder Sain Taneja
33576	Chandulal Gokaldas Kadia
33577	Banarsi Dass Sangal
33578	Krishna Chandra Parida
33579	Mijar Payyarabettu Prabhakara
33580	Sukhendu Bikash Paul
33581	Jagdish Prasad
33582	Shankar Lal H. Purswani
33583	Akshey Kumar Mathur
33584	Nirbhaya Singh Dubey
33585	Baburao Govind Kattimani
33586	Indravadan Natwarlal Shah
33587	Krishna Chandra Srivastava
33588	Jagjit Singh Chaudhry
33589	Babarao Dadarao Thakur
33590	Rajendra Kumar Tyagi
33591	Tryambak Krishnaji Date
33592	Keshav Dutt Parashar
33593	Atma Singh Erani
33594	Mekkattuparambil Vareed Thomas
33595	Rajendra Prasad Tiwari
33596	Jitendra Prasad Rastogi
33597	Murugappa Achari Panchaksharam
33598	Dhirendra Prasad Tiwari
33599	Vakil Ur Rahman
33600	Virendra Kumar Shukla
33601	Vadi Kothandaram Narayanaswamy
33602	Charan Dass Sachdeva
33603	Prem Nath Gupta
33604	Ranvir Singh Yadav
33605	Sailesh Chandra Bhattacharyya
33606	Om Parkash Dalwani
33607	Satyendra Nath Bhatnagar
33608	Prem Prakash Verma
33609	Bhujangarao Vittal
33610	Anantram Subrao Bhatta
33611	Lac Puduppakkam Srinivasan Venkatraman
33612	Shiv Nath
33613	Rajagopala Chakravarthy
33614	Balraj Lamba
33615	Vijaykumar Tityasaheb Patil
33616	Mambakkam Krishnamoorthy Devarajan
33617	Bansilal Khivaraj Chordiya
33618	Padmakar Dattatraya Chitre
33619	Kalwant Rai
33620	Nagindas Thakordas Soneria
33621	Sunil Kumar Paul

STUDENTS (*contd.*)

No.	Name
33622	Ripu Daman
33623	Mohinder Singh Khurana
33624	Dasharathlal Khemchand Shah
33625	Viswanathan Raman
33626	Saraff Shamarao
33627	Surjit Singh Gill
33628	Dilip Kumar Sarkar
33629	Mohan Lal Kochhar
33630	Rameshchandra Madhavlal Barot
33631	Suhas Vinayak Joshi
33632	Ramesh Shantinath Manorkar
33633	Kishin Janardhandas Bhojwani
33634	Krishnaswamy Parangusam
33635	Sharad Chandra Sadh
33636	Rakesh Srivastava
33637	Narayanbhai Shivram Patel
33638	Vinodchandra Ramanlal Patel
33639	Ramjanam Singh
33640	Nirmal Kumar Bose
33641	Pathangi Velamur Srinivasan
33642	Kilpady Padmanabha Mayya
33643	Rohinton Nadirshaw Patel
33644	Ramesh Chander Joshi
33645	Narendra Narayan Singh
33646	N. Shankarappa
33647	Lala Somendra Prasad
33648	Rajendraprasad Priyadatta Shastri
33649	Gulzar Singh Chauhan
33650	Pritam Singh Bhutiani
33651	Ajodhya Prasad
33652	Baleshwar Sinha
33653	Abdul Qader Abdur Rehman
33654	Manmohan Singh Chopra
33655	Ram Narain Ojha
33656	Yash Paul Sharma
33657	Gupteshwar Nath Saraswat
33658	Shantaram Narayan Shirwadkar
33659	Tarsem Chand Chopra
33660	Nardev Singh Chauhan
33661	Darshan Lal Gupta
33662	Satish Chander Sharma
33663	Narendra Nathan Nair
33664	Krishnamurthy Parameswaran
33665	Rajnikant Dhirajlal Shah
33666	Swarn Lal Mehta

No.	Name
33667	Dinesh Chandra Goyal
33668	Jaswant Singh Bahra
33669	Shankar Dass Khepar
33670	Bopa Ram Gogoi
33671	Bal Krishan
33672	Deo Bansh Pandey
33673	Jetho Dhanrajmal Hukmani
33674	Satish Kumar Varma
33675	Dinavahi Sree Rama Rao
33676	Jaswant Rai Ahuja
33677	Prem Nath
33678	Haridas Jagannath Patil
33679	Mohamed Sirajuddin Ansari
33680	Jehangir Kaikhushroo Shroff
33681	Ram Kishan
33682	Rajinder Dev Sood
33683	Narendra Prasad
33684	Sheonandan Prasad
33685	Mohammed Irfan
33686	Yusuf Ishakbhai Sitabkhan
33687	Ashoke Kumar Sinha
33688	Gopaldas Govinddas Shroff
33689	Narayanaswamy Ramakrishnan
33690	Kalpathy Venkatram Ramdas
33691	Ishwar Tuljaram Hingorani
33692	Pazhayannur Venkateswaran Subrahmanyan
33693	Lakshmanaiyer Ramachandran
33694	Subramania Srinivasan
33695	Sumanbhai Bhailalbhai Shekh
33696	Hari Shanker Jha
33697	Mrinal Kanti Mukherjee
33698	Raghbir Singh Rajput
33699	Bhagavathipillai Thankappan Nair
33700	Harbhajan Singh Marvaha
33701	Lac Isher Singh Gill
33702	Labh Chand
33703	Raghunatha Narayanan
33704	Madhukar Harishchandra Purandare
33705	Vippagunta Pattabhi Rama Rao
33706	Narayana Santhanaraman
33707	Veluthookaren Lazar Thomas
33708	Pachipulusu Mukunda Mohana Rao
33709	Doddavaram Narayana Rao
33710	T. S. Subbarathinam

STUDENTS (*contd.*)

No.	Name
33711	Mocherla Balaramaiah Setty
33712	Shantaram Mahipat Sonar
33713	Jagadesan Nithyanand Iyer
33714	Ramakrishin Gulrajani Ramesh
33715	M. V. Joga Rao
33716	Mohideen Seyedibrahim Ameer Batcha
33717	Ramachandraiyer Rajamani
33718	K. S. Jayaraman
33719	Krishnan Krishnan Raveendranathan
33720	Mahadeva Venkateswaran
33721	Karikkanthara K. Divakaran
33722	Bhola Mandal
33723	Tirunarayanan Venkatadri
33724	Roopa Ram Shahu
33725	Bimal Chandra Mohan
33726	Manohar Lal Rustgi
33727	V. Rajamani
33728	Vasudeo Mahadeo Gadre
33729	Mathra Dass Arora
33730	D. S. Subbarayan
33731	Meka Nageswara Rao
33732	Darshan Singh Bhatia
33733	Mohan Krishna Mehra
33734	Ram Nihor Tripathi
33735	Hari Dev Vaid
33736	Shaik Abdul Azeem
33737	Mukund Vasudeo Joshi
33738	Balbir Singh Budhraja
33739	Gopal Krishan Gulati
33740	S. Sethumadhavan
33741	Meka Krishna Murthy
33742	Venkatraman Vaidyanathan
33743	Varghese Jacob
33744	Chinnaswamysetty Venkatesh Prasad
33745	Anantharama Prabhu
33746	Arun Hari Apte
33747	H. Narayana Aithal
33748	Vijay Trimbak Raste
33749	P. P. Paul
33750	Kuchibhatla Harinarayana
33751	Kataru Sai Baba
33752	Nimmagadda Venkata Rama Sastry
33753	Cpl. Narendra Nath Bhardwaj
33754	Tulsi Dass
33755	Amiyo Kumar Moitra
33756	Sham Dass
33757	Vinod Kumar Sinha
33758	Shiv Shanker Singh
33759	Anand Prakash Kumra
33760	Vilas Govindrao Babtiwale
33761	Vedula Jayarama Murty
33762	Cpl. Pallipurath Radhakrishnan
33763	Viru Kakanmal Lalwani
33764	Pooran Chandra Khare
33765	Gurmukh Singh
33766	Naresh Kumar Sharma
33767	Govind Ram Golhani
33768	Raj Kumar Bhatia
33769	Madan Lal Sharma
33770	Darshan Singh
33771	Amitava Choudhury
33772	Sunder Lal Verma
33773	Ramzan Ali
33774	Manachanallur Viswanatha Nagarajan
33775	Prakash Anant Kulkarni
33776	Ramachandra Keshav Mahishi
33777	Annappa Anant Prabhu
33778	Surrendar Nihchaldas Bablani
33779	Ram Singh Choudhary
33780	Virendra Kumar
33781	Subhash Chander Dua
33782	Tej Pal Singh Verma
33783	Subhag Ram Sachdev
33784	Ram Kumar Dixit
33785	Dharam Paul Goel
33786	Teekam Chand
33787	Shanker Lal Sunar
33788	Arjan Shewaram Lokwani
33789	Kamlendra Kumar Jha
33790	Brij Pal Tomar
33791	Surapaneni Venkata Rao
33792	Shanti Sarup Dhir
33793	Chaman Babu Mathur
33794	Ramanuj Lal Shrivastava
33795	Jagdish Singh Bal
33796	Kartapalayam Venkataram Subramani
33797	Dhannalal Chhajjuma Gupta
33798	Ram Swarth Thakur
33799	Pabitra Kumar Bose
33800	Pashupati Nath

STUDENTS (*contd.*)

No.	Name
33801	Chhotalal Jayantilal Soni
33802	Mohinder Pal Singh Batta
33803	Mahendrakumar Popatlal Bhojak
33804	Shaik Akbar Hussain
33805	Prabhakar Shankar Sheth
33806	Yelchuri Jagannadham Chetty
33807	Gurmukh Singh Dorka
33808	Damodar Mishra
33809	Godlaveti Subramanyam
33810	Cpl. Hariharaiyer Ramachandra Iyer
33811	Kopparam Haranath Gupta
33812	Ramniklal Keshavlal Bharad
33813	Vallabhdas Meghjibhai Balochiya
33814	Tapan Kumar Dutta
33815	Lingamneni Kakuleswara Rao
33816	Lalit Mohan Das
33817	Yadavalli Gopala Krishna Murty
33818	Abdulgani Usufmia Malik
33819	Ravindra Bhalchandra Patankar
33820	Shashikant Laxmikant Moholkar
33821	R. Somasundaram
33822	Pradip Vimalbhai Modi
33823	Gunvant Chandulal Shah
33824	Narsinhaprasad Kalyanjibhai Chauhan
33825	Gurcharan Singh
33826	Bhimaraya Appanna Kanakareddi
33827	Shankarabhatta Sambabhatta Joshi
33828	Trailokya Nath Sarangi
33829	Mohan Narayan Hegde
33830	Hrusikesh Pany
33831	Krishnasamy Narayanasamy Krishnasamy
33832	Dilip Kumar Bhattacharjee
33833	Kalavagunta Sambasiva Pillai
33834	Purum Narasimhulu
33835	Gobardhan Dora
33836	Trinath Jena
33837	Narayan Prasad Nayak
33838	K. R. Seshadri
33839	Ram Narain Sarin
33840	Ramineedi Ramachandra Rao
33841	Shivaji Shankar Rokade
33842	Ravikumar Vishnu Jawadekar
33843	Anant Laxman Rokade
33844	Prasenjit Kumar Banerjee
33845	Chandrakant Ganpati Bartakke
33846	R. Prabhakar
33847	Abdur Raoof Kazmi
33848	Dhirendra Nath Ray
33849	Amal Kumar Roy
33850	Nikhil Chandra Chakraborty
33851	Dipankar Ghosh
33852	Ramjiban Bhattacharya
33853	Kamal Kumar Kar
33854	Ajoy Kumar Ghosh
33855	Ramesh Ramkrishna Bagde
33856	Achyut Shankar Jog
33857	Suresh Damodar Tikhe
33858	Gejinder Singh Sehgal
33859	Sukadev Shrawan Gajare
33860	Ram Chand Bhateja
33861	Akbar Saheb
33862	Sohan Lal Azad
33863	Daya Shanker Agarwal
33864	Bhagwant Gajanan Kale
33865	Manmohan Singh Dhillon
33866	Narayan Narhar Bhise
33867	Sunil Kumar Choudhuri
33868	Nallur Srinivasarao Jayathirtha Rao
33869	Kamal Kumar Saha
33870	Sanjib Kumar Paral
33871	Sankar Kumar Mukherjee
33872	Gour Das Nandi
33873	Jayanta Kumar Roy
33874	Abhoy Kumar Chakraborty
33875	Anil Kumar Bandyopadhyay
33876	Sisir Kumar Mukherjee
33877	Dilip Kumar Chakrabortty
33878	Jagat Narayan Singh
33879	Sudhamadhab Bhaduri
33880	Chandi Charan Mitra
33881	Gopal Chandra Chatterjee
33882	Nimishakavi Sree Hari Venkata Subba Rao
33883	Mukund Prabhakar Gupte
33884	Rajasekhar Siddappa Tipshetty
33885	Brundaban Sahoo
33886	V. S. Venkitakrishnan
33887	Jaswant Ram Sharma
33888	Mutyala Venkataraju
33889	Basavaraj Appayya Hiremath
33890	Natesa Srinivasan

STUDENTS (*contd.*)

No.	Name
33891	Gangadhargouda Linganagouda Patil
33892	Yusuf Gulamhusain Poonawalla
33893	Surendra Mohan Arora
33894	Narain Tuljaram Khudabadi
33895	Purushottam Kondaji Dhoraje
33896	Ram Niwas Sharma
33897	Mukhtiar Singh Parwana
33898	K. S. Parasuramakrishnan
33899	Kavasseri Narayanaiyer Agneeswaran
33900	Kobad Maneckshah Panthaki
33901	Himadri Chaudhuri
33902	Shahurao Ganpatrao Dube Patil
33903	Panchanan Roy Choudhury
33904	Gurnam Singh
33905	Arun Kumar Mitra
33906	Chandrashekhar Govindrao Jaiwant
33907	Ashok Kumar Mehta
33908	Santanu Choudhuri
33909	Pradip Kumar Mukhopadhyay
33910	Rabindra Nath Basu
33911	Bhagwan Swarup Nigam
33912	Chandra Prakash
33913	Prasanta Kumar Chakrabarty
33914	Vijay Kumar Bansal
33915	Ashok Kumar Baweja
33916	Nirmal Chandra Karnawat
33917	Krishna Pandurang Shanbhag
33918	Omprakash Shyamlal Gupta
33919	Arun Ganpatrao Gupte
33920	Arjun Singh
33921	Bhojo Assudomal Advani
33922	P. A. Chacko
33923	Malay Kant Chatterjee
33924	Gurumurty Jena
33925	Seggurti Madhusudhana Rao
33926	Sumantray Rambhai Patel
33927	Kothapalli Madhava Rao
33928	Madan Sen
33929	Pramod Shridhar Sane
33930	Vijaykumar Digambar Deshpande
33931	K. S. Venkatesan
33932	Shivram Gopalrao Lele
33933	Prabhakar Jagannath Karkhanis
33934	Konaje Somanath Rao
33935	Shridhar Narayan Jogalekar
33936	Mantripragada Krishnamurty
33937	Sheo Prasad Pandey
33938	Madhav Moreshwar Deodhar
33939	Chandra Mohan Bhatia
33940	Ramireddy Gopala Reddy
33941	Virendra Kumar Shrivastava
33942	Amupindi Satyanarayana Murty
33943	Prem Kumar Bhatla
33944	Ramesh Chandra Gupta
33945	Suresh Vishnu Deurkar
33946	Md. Thyab
33947	Surendra Narain Bisaria
33948	Pavar Jagannatharao Vasudeva Rao
33949	Mangalore Shivaram Vittal
33950	Samarendra Nath Roy
33951	Ganti Gopala Krishna Murty
33952	Mokkapati Raman
33953	Hari Shanker Srivastva
33954	Abdul Hadi M. Shaikh
33955	Suresh Narayanrao Cherekar
33956	Bipul Krishna Ghosh
33957	Kantilal Bapalal Shah
33958	Vinayak Hanamant Palande
33959	Nandina Balarama Murty
33960	Manohar Keshav Lele
33961	Prem Singh
33962	Danturthi Appala Bhaskar Rao
33963	Kailash Chandra Gupta
33964	Prahaladdas Jajoo
33965	Sanat Kumar Bhattacharyya
33966	Subhas Chandra Basu
33967	Bellur Krishnaswamy Panduranga
33968	Jitendra Harjivan Timbadia
33969	Nandiraju Krishna Rao
33970	Lakhiram Shrawan Makdey
33971	Vonkayalapaty Yethi Ramanujacharyulu
33972	Jaswant Singh Bedi
33973	Sharad Mahadeorao Wele
33974	Shanker Bhagwant Belsare
33975	Coolimuttam Narayanan Balasubramanian
33976	Vidyadhar Deshpande
33977	Kantilal Prabhudas Patel
33978	Shyam Sunder Gulati
33979	Anil Vasudeo Agashe
33980	Arun Pandav

STUDENTS (*contd.*)

No.	Name
33981	Sheshrao Vyankatrao Patil
33982	Ashok Gopinath Tendulkar
33983	Ankush Dattaram Dalvi
33984	Navinchandra Jadavji Gosalia
33985	Pravinchandra Manshanker Rawal
33986	Dharm Pal Banbah
33987	Chandulal Vrajalal Lakhani
33988	Dhandina Yerrappa
33989	Narain Kauromal Balwani
33990	Subramania Ganeshan
33991	Gurcharn Singh Sidhu
33992	Amarnath Jiwatmal Kapoor
33993	Rajnandan Thakur
33994	Shri Prakash Mishra
33995	Dharm Vir Sobti
33996	Prabhakar Jagannath Joshi
33997	Maganlal Chunilal Mavani
33998	Sambandam Ganesan
33999	Hoshedar Sorabji Dalal
34000	Gangadhar Datta
34001	Ayyagari Pattabhi Raman
34002	Suresh Baburao Naik
34003	Pratap Laxman Mahadik
34004	Dineshchandra Thakordas Kania
34005	Ghansho Shewakram Hassani
34006	Prem Chand Tyagi
34007	Rambhai Ishwarlal Patel
34008	Ajay Kumar Mehrotra
34009	Rusi Hormusji Pavri
34010	Brajabandhu Rath
34011	Rajkumar Subhkaran Saraf
34012	Jayant Annaji Shrotri
34013	Santosh Singh Minhas
34014	Pritam Sahibroy Sukhramani
34015	Maheshchandra Bhimbhai Desai
34016	Kapil Deo Singh
34017	Rajaram Vinayak Muley
34018	Balwantrai Jivanji Patel
34019	Baleshwar Singh
34020	Joginder Singh Marwaha
34021	Venkiteswaraiyer Sankaran
34022	Padmakar Sadashiv Panse
34023	Rajendra Kanakrai Rindani
34024	Roshan Lal Ailawadia
34025	N. Venkataramachetty Subbarayappa
34026	Gujjar Mylarappa Pundaleeka Rao
34027	Baban Nagnathrao Kamble
34028	Ganesh Digambar Gownade
34029	Kuppa Venkata Krishna Sastry
34030	Prem Sagar Sobt
34031	Shridhar Prabhakar Harkare
34032	Chandrakant Balavant Kulkarni
34033	Rajinder Singh Nanda
34034	Konnanath Thokethil Sankaranarayanan
34035	Bira Kishore Patnaik
34036	Bhagvatprasad Chandrakant Pancholi
34037	Prabhakar Narayan Gosavi
34038	Bhimaji Shankarrao Kulkarni
34039	Jashavantlal Chhotalal Shah
34040	Panchanady Parameshwaran
34041	Koduvayoor Viswanathan Venkiteswaran
34042	Bhupendra Hiralal Pathak
34043	Janakray Bhalchandra Bhatt
34044	Sureshchandra Shivajirao Phadtare
34045	Basant Kumar Sharma Chotia
34046	Uttam Beshasingh Kukreja
34047	Prakash Chandra Agarwal
34048	Kishorkant Dulerai Bhuta
34049	Kailash Chandra Mital
34050	Prem Dyal Sharma
34051	Harbans Lal Aggarwal
34052	Astom Chandra Roy
34053	Ashokkumar Ramniklal Desai
34054	Madhav Anandrao Tanjorekar
34055	Pankaj Kumar Pramanik
34056	Gandharv Raj Kapila
34057	Romesh Chand
34058	S. Ganapathy
34059	Ashis Das Gupta
34060	Avinash Shripad Naik
34061	Krishan Mohan Asthana
34062	Vijaykumar Laxman Kulkarni
34063	Indravadan Kantilal Shah
34064	Uggar Sain
34065	Surya Deo Upadhyay
34066	Srinivas Ragothama Rao
34067	Gangadhar Dhondo Phadke
34068	Sureshchandra Ramchandra Jadhav
34069	Aditya Narain Singh
34070	Govind Sacchitanand Prasad

STUDENTS (*contd.*)

No.	Name	No.	Name
34071	Rama Kant	34116	Raj Kumar Gupta
34072	Suresh Atmaram Wekhande	34117	Satya Pal
34073	Jagannath Vishwanath Bhise	34118	Kanubhai Chimanlal Shah
34074	Ramanthampi Radhakrishnan Nair	34119	Jayendra Mugatlal Mehta
34075	Putturao Martu Gole	34120	Raj Mohan Singh
34076	Baldev Krishan Gupta	34121	Shri Nandan'Jain
34077	Abhay Narayan Singh	34122	Ram Sharan Prasad
34078	Ajit Raghunathrao Parandekar	34123	Dilip Kumar Mukherji
34079	Kunnath Poyil Gangadharan Nambiar	34124	Harpal Singh
34080	Shrikant Damodar Nimbkar	34125	Dwarika Prasad Agrawal
34081	Kivaluru Subramanya Sarma Venkatraman	34126	Kanhaiya Prasad
34082	Khagesh Chandra Dutta	34127	Vijay Bhagwanji Champaneria
34083	Thakur Viroomal Sawlani	34128	Satya Paul Goyal
34084	Suraj Prakash Chawla	34129	Surinder Mohan Gupta
34085	Pramodkumar Maneklal Shah	34130	Bhovi Ramanna
34086	Kewal Chand Mittal	34131	Shiv Kumar Goyal
34087	Lakshmi Kanthan Thotapalli	34132	Jitendriya Pal Likhi
34088	Munna Lal Jain	34133	Kuldip Singh Sodhi
34089	Sasanka Sekhar Mukherjee	34134	Thadathil Iype Anthrayose
34090	Ramnarain Arora	34135	Bechan Lal Shrivastava
34091	Ishwar Lal Kripalani	34136	Uma Shakar Tiwari
34092	Chaturbhuj Kanayalal Bhatia	34137	Surinder Kumar Jain
34093	Triloki Nath	34138	Cpl. Daulat Ram Luthra
34094	Jata Shankar Srivastava	34139	Ajit Singh Chhatwal
34095	Mrinal Kanti Ghosal	34140	Bharathkumar Madhusudan Ingreji
34096	Mullankandy Palliath Chandrasekharan	34141	Shri Krishan Lal
34097	Raj Krishan Gandhi	34142	Sadho Pandey
34098	Rajesh Kumar Hajela	34143	Meghji Liladhar Bhanushali
34099	Gian Singh Saini	34144	Kanubhai Sankalchand Patel
34100	Sharad Ramchandra Harshe	34145	Kiritkumar Jadavlal Desai
34101	Mukhtiar Singh	34146	Dhirajkumar Kantilal Thakur
34102	Kharaiti Lal Tandon	34147	Sudhir Kumar Goyal
34103	Raghunandan Choudhury	34148	Jabdish Raj Sarpal
34104	Hajari Lal Kosta	34149	Gopal Krishna Sharma
34105	Baljit Singh Khosa	34150	Inderjit Singh
34106	Ponnathpuram Muthanna Rangaraj	34151	Premkumar Mulchand Advani
34107	Bibekananda Chaliha	34152	Dhurandhar Songh Thakur
34108	Jagadish Chadd Sharma	34153	Ram Ratan Prasad
34109	Honnenahalli Srinivasaiyengar Kannan	34154	Rajinder Kumar Kochhar
34110	Naresh Chandra Srivastava	34155	Ramesh Chander Ahuja
34111	Dharam Prakash	34156	Amritlal Dhulabhai Suthar
34112	Ramnath Ganpat Pendnekar	34157	Govind Prasad Dubey
34113	D. S. Murthy	34158	Hasan Ibrahim Deshu
34114	Sukhdev Singh Walia	34159	Shripad Shankar Purohit
34115	Kailash Nath Pandey	34160	Harbhajan Singh

STUDENTS (*contd.*)

No.	Name
34161	Ratilal Himatlal Belani
34162	Gunvantray Karashanji Shah
34163	Suresh Sankalchand Shah
34164	Sakti Kumar Chopra
34165	Satish Chander Gupta
34166	Sunkarapalli China Venkata Rao
34167	Kundan Lal Sethi
34168	Yogesh Chandra Agarwal
34169	P. V. Ganesan
34170	Vishnudas Bulchand Khatry
34171	G. K. Subramanian
34172	Piaray Lal Jalali
34173	Pushpendra Kumar Gupta
34174	Mrinal Kanti Sarkar
34175	Gajendra Prabhulal Desai
34176	Abdul Wahid Shakir
34177	Bertie Walters
34178	Amaresh Chandra Goswami
34179	Eddhula Linga Reddy
34180	Vinod Kumar Srivastava
34181	L. Kannan
34182	Kariampujha Vargheese Joseph
34183	Mandalika Visweswara Rao
34184	Karunamoy Ghosh
34185	Chandi Das Bhattacharyya
34186	P. Krishnamurthy Viadhyanadhan
34187	Deoki Nandan Goyal
34188	Preetam Naraindas Raisinghani
34189	Vincent Gregory Joseph
34190	Nukala Satyanarayana
34191	Arunachalam Balasubramanian
34192	Jai Bhagwan
34193	Arun Kumar Bhattacharjee
34194	Gour Gopal Das
34195	Asish Kumar Gupta
34196	Biswapati Ghosh
34197	Arup Kumar Sinha
34198	Raghunath Bhattacharyya
34199	Vijeendra Kumar Saksena
34200	Surjeetsingh Charansingh Mahajan
34201	Ganapathy Parasurama Sarma
34202	P. Chandrasekharan
34203	Narayanaswami Venkatesan
34204	Abhay Kumar Samanta
34205	Pramod Kumar Singhal
34206	P. S. Kumaraswamy
34207	Krishan Lal Suri
34208	Krishna Kumar Gupta
34209	Chittaranjan Roy
34210	Niranjan Saha
34211	Amrik Singh
34212	Satya Prakash Malhotra
34213	Harish Chandra
34214	Gopalrao Ramanarasaiyan
34215	Inorajeet Sharma
34216	Sukomal Bhattacharjee
34217	Sishir Kumar Bakshi
34218	Amar Kumar Chatterjee
34219	Amar Nath Kukherjee
34220	Prasanta Kumar Kusari
34221	Ram Naraindas Sajnani
34222	Jagdishchandra Manshankar Dave
34223	Surendra Kumar Shukla
34224	Bajrangi Rai
34225	Ramaswamy Shanmugavelayutham
34226	Malay Mohan Ray
34227	Suresh Chandra Dey Sarker
34228	Kalyan Kumar Chattopadhyay
34229	Sukumar Basu
34230	Wahiduddin
34231	Tapan Kumar Bir
34232	Sankar Prasad Bagchi
34233	Surrinder Kumar Bahl
34234	Sundara Kalyanam
34235	Swarn Jit Singh Som
34236	Tushar Kanti Roy
34237	Sushil Kumar Kundu
34238	Amiya Kumar Chakravarti
34239	G. Gopalakrishnan
34240	Baidya Nath Roy
34241	Sudhir Kumar Kaviraj
34242	Satya Priya Das
34243	Ajit Kumar Patra
34244	Kalinga Mohan Mandal
34245	Raghunath Sahai Jain
34246	Santosh Kumar De
34247	Muthukkaruppan Ramasamy
34248	Arun Kumar Saha
34249	S. Balakrishnan
34250	Kali Prasanna Bhattacharya

STUDENTS (*contd.*)

No.	Name	No.	Name
34251	Kanailal Maity	34296	Nirmal Kumar Mondal
34252	Arun Kumar Bardhan	34297	Kanchan Das Gupta
34253	Jamuna Singh	34298	Arjun Prasad Mandal
34254	Ramesh Chandra Sharma	34299	Dilip Kumar Chakrabarty
34255	Pranab Kumar Basu	34300	Venkiteswaran Viswanathan
34256	Hirak Banerjee	34301	Chitta Rajan Deb
34257	Basudeb Acharjee	34302	Satya Narain Sinha
34258	Prabir Kumar Ray	34303	Gourab Hari Chatterjee
34259	Shyamal Kumar Ghosh	34304	Nepal Chandra Patra
34260	Sukumar Ghosh	34305	Vinay Kumar Mathur
34261	Dilip Kumar Chandra	34306	Ajit Kumar Basu
34262	Manik Lal Banerjee	34307	Mohan Lal Kewalram Ramrakhiani
34263	Ranjit Kumar Ray	34308	Tirath Dass Kathuria
34264	Durga Sankar Mookerjee	34309	T. P. Raghavan
34265	Kshitish Chandra Sutradhar	34310	Ramkrishna Datta
34266	Amitabha Basu	34311	Sujit Kumar Ghosh
34267	Gopal Chandra Gupta	34312	Satadal Chatterjee
34268	Sukanta Niyogi	34313	Satiranjan Das
34269	Mukunda Lal Koley	34314	Shyamal Kumar Sen Gupta
34270	Arun Kumar Banerjee	34315	Roop Kishore
34271	Salil Kumar Datta	34316	Narayan Hanamantrao Marali
34272	Arun Uday Dutta Roy	34317	Gurbux Singh
34273	Gopala Krishnan Ranganathan	34318	Bhogaraju Satyanarayana
34274	Pritesh Chandra Ghose Roy	34319	Narendra Kumar Goyal
34275	Jai Parkash Aggarwal	34320	Prem Nath Seth
34276	Rabindra Narayan Debbhoumik	34321	Hari Ram Sharma
34277	Sudhindra Kurrar Biswas	34322	Prashanta Kumar Chakrabarty
34278	Rathindranath Ghosh	34323	Prafulla Kumar Seth
34279	Animesh Sen Gupta	34324	Anindya Ghose
34280	Jit Ram Hooda	34325	Milan Kumar Ghosh
34281	Shaik Ibrahim	34326	Somen Kusum Sen
34282	Kalyan Kumar Basu	34327	Sudhangshu Bhusan Gupta
34283	Des Raj	34328	Pranab Kumar Seth
34284	Vinnakota Venkata Krishna Rao	34329	Arunasis Mitra
34285	Bhagwan Dass Singal	34330	Hara Kumar Das
34286	Virinder Kumar Mehna	34331	Sankar Nath Mitra
34287	Ananta Lal Shaw	34332	Ansu Kumar Mitra
34288	Darshan Kudar Ralhan	34333	Syamal Ray Chaudhuri
34289	Yudhishthir Sardana	34334	Asit Kumar Debnath
34290	Gopal Singh Bisht	34335	Sudhir Chandra Ray
34291	Hara Prasad Dey	34336	Arun Kumar Basu
34292	Subir Bose	34337	Bejay Kumar Sen Gupta
34293	Debabrata Ghosh	34338	Ved Prakash Bhardwaj
34294	Jatindra Mohan Roy	34339	Manohar Moreshwar Deshmukh
34295	Ames Kumar Dalal	34340	Kailash Chand Kansal

STUDENTS (*contd.*)

No.	Name
34341	Ram Swarup Sharma
34342	Cherukuri Venkata Krishna Swamy
34343	Shyamal Kanti Das Gupta
34344	Asim Bishnu
34345	Arun Kumar Majumdar
34346	Adhip Kumar Ghosh
34347	Asha Kukul Das
34348	Diptis Chandra Goswami
34349	Chaturbhuj Nanikram Gidwani
34350	Ganapati Ghose
34351	Sujit Kumar Bandyopadhyay
34352	Prasanta Kumar Chaudhuri
34353	Aloka Nath Gangopadhyay
34354	Prasanta Kumar Ghosh
34355	Bellary Ethirajulu
34356	Chandur Bhatia
34357	Yudhishtar Raj Soni
34358	Ramesh Chander Madan
34359	Rameshchandra Ganpatrao Parulkar
34360	Milanratan Bhattacharyya
34361	Vemuganti Rama Rao
34362	Ajit Kumar Mondal
34363	Kalyan Kanti Dhar
34364	Aloke Nath Mukherjee
34365	Sanat Kumar Rakshit
34366	Ajoy Krishna Mukherjee
34367	Ranjit Kumar Gupta
34368	Dipendra Nath Banerjee
34369	Gopinath Banerjee
34370	Hrishikesh Bit
34371	Samar Kumar Basu
34372	Santosh Kumar Chakrabarti
34373	S. Neelambal
34374	Monoranjan Chakrabartty
34375	Amalendu Sau
34376	Amar Nath Mukhopadhyaya
34377	Nalini Ranjan Nath
34378	Satyabrata Bose
34379	Bijoy Krishna Mandal
34380	E. Narayanannair Ravindran Nair
34381	Asish Kanti Dam
34382	Arun Krishna Joardar
34383	Ajit Kumar Mukhopadhyay
34384	Nachhattar Singh Matharu
34385	Siddheswar Mukhopadhyay
34386	Subir Kumar Sarkar
34387	Rajendra Kumar Minocha
34388	Bansi Mohan Garyali
34389	Ram Autar Gupta
34390	Debesh Chandra Chattopadhyay
34391	Sankar Lal Mukherjee
34392	Narendra Nath Haoldar
34393	Dilip Kumar Mitra
34394	Amar Kumar Ghosh
34395	Nikhil Kumar Roy Choodhury
34396	Hiralal Chatterjee
34397	Paritosh Basu
34398	C. S. Sivaramakrishnan
34399	Seetharama Subramanian
34400	Anupam Sen
34401	Sankhya Kapil Sen
34402	Basudev Chattopadhyaya
34403	Dipak Kumar Bose
34404	Radha Ballabh Bandyopadhyay
34405	Sanat Kumar Chatterjee
34406	Achintya Kumar Sen
34407	Saurendra Narayan Misra
34408	Nripendra Chandra Roy
34409	Biplab Kumar Bahdyopadhyay
34410	Sambhu Nath Karmakar
34411	Niranjan Deb
34412	Samir Prasad Ganguly
34413	Jayanta Kumar Ghatak
34414	Abhoy Pado De Sarker
34415	Deba Prasad Ray Chaudhuri
34416	Dipak Chattopadhyay
34417	Jayanta Kumar Sengupta
34418	Naresh Chandra Chakraborty
34419	Satty Narayana Reddy
34420	Harbhajan Singh Sehoal
34421	Dhirajlal Chandulal Shah
34422	Pranab Kumar Sarkar
34423	Biplab Kumar Chakraborty
34424	Prasanta Kumar Nath
34425	Bikash Kumar Ganguly
34426	Sankar Chandra Dutta
34427	Thippavajjula Ramamurthy
34428	Bongarala Rama Mohan Rao
34429	Sirdar Akber Khan
34430	Shantaram Balkrishna Nagaonkar

STUDENTS (*contd.*)

No.	Name
34431	Prem Nath Bhatia
34432	Chigurupati Parameswara Rao
34433	Saligram Nabayanasastry Jambunathan
34434	Chander Prakash Nathani
34435	Dharmabrata Ghosh
34436	Ajoy Kumar Datta
34437	Tushar Kanti Chongder
34438	Jagat Narayan Sinha
34439	Gudivada Purna Venkata Hanumantha Rao
34440	Mohinder Narain Dhawan
34441	Vinay Kumar Singh
34442	Khambhammettu Adi Sesha Somabrahmananda Rao
34443	Rustom Kaikhushru Bharucha
34444	Tripathi Prasad Gupta
34445	Jai Pal Goel
34446	Vinod Kumar Thareja
34447	Shyam Sundar Agarwal
34448	Riyaz Ahmed Khan
34449	Ramesh Chander Malhotra
34450	Man Mohan Mehra
34451	Hari Mohan Srivastava
34452	Hari Mohan
34453	Prem Chandra Agarwal
34454	Sukumar Mukherjee
34455	Niranjan Singh Ailsinghani
34456	Harijaspal Singh Hora
34457	Krishna Kumar Hazra
34458	Ajit Kumar Bhattacharyya
34459	Amulya Ratan Sarkar
34460	Baidyanath Chowdhury
34461	Bikash Krishna Saha
34462	Bratindra Banerjee
34463	Dwaraka Nath Moulik
34464	Nanda Dulal Ghosh
34465	Nirmal Kumar Saha
34466	Pulickal Govindankutty Menon
34467	Rathindra Nath Mitra
34468	Swapan Das Gupta
34469	Tapas Kumar Sanyal
34470	Tapan Kumar Dutta
34471	Satyabrata Sen Gupta
34472	Ananda Rajan Majumdar
34473	Amal Kumar Kar
34474	Amalendu Dalal
34475	Sushil Kumar Sen
34476	Niranjan Prakash Gupta
34477	Bhagwant Singh
34478	Pendyala Sreenivas
34479	Gour Chandra Pradhan
34480	Kadayam Ramabhadra Srinivasan
34481	Kalyan Das Arhatia
34482	Samireswar Bose
34483	Satyendra Nath Sengupta
34484	Murari Mohan Saha
34485	Shyamaprasad Ghose
34486	Tupurani Ramanujachari
34487	Karmadhiah Raj Bhandari
34488	Punyamurtula Venkata Raghava Rao
34489	Chireddy Venkata Rami Reddy
34490	Donthu Siddaiah
34491	Jyotish Kumar Bhattacharya
34492	Swetamber Chatterjee
34493	Vempati Chinna Mutyala Rao
34494	Dayal Dass Kakumal Chandiramanai
34495	Nand Lal
34496	Upinder Dutt Shukla
34497	Prakash Kanchan
34498	Mahadasu Venkateswara Rao
34499	Lankada Appa Rao
34500	Kotamraju Rama Krishna Anjaneyulu
34501	Ruddaraju Venkata Raju
34502	Om Prakash Garg
34503	Koripella Rama Rao
34504	Krishnadeo Prasad Singh
34505	Palaparti Bhaskara Rao
34506	Macharla Raman Goud
34507	Jivan Ambadas Kayande
34508	Pataneni Gopala Krishna Murtey
34509	Kailash Chander Pathella
34510	Bhau Ramchandra Kulkarni
34511	Rajkishore Prasad
34512	Pitamber
34513	Dhurjaty Venkata Seshiah
34514	Achilles Anthony D. Souza
34515	Radhakishin Thakurdas Merani
34516	Dodda Appa Rao
34517	Jayanthi Satya Lakshmi Narasimha Rao
34518	Parasa Venkata Seetha Rama Sarma
34519	Mahendra Kumar Agarwal

STUDENTS (*contd.*)

No.	Name
34520	Manohar Narayanrao Gosewade
34521	Juluru Kodandapani
34522	Racharla Vittal Rao
34523	Chakravarthy Ranganathachar Dore
34524	Baliram Sitaram Gawande
34525	Chilukuri Radhakrishna Murty
34526	S. Ananthaswamy Rao
34527	Kadambi Seshadri
34528	Jata Nath Jha
34529	M. K. Ganesh
34530	Jodendra Prasad Sinha
34531	Ashok Ram Chandra Dantale
34532	Vijaykumar Nagorao Tambe
34533	Ganesh Chandra Kharwas
34534	Khoj Abdullabhai Fatehi
34535	Raghunath Sadashivrao Tiwalkar
34536	Vasant Pandurang Datar
34537	Ivan Joseph Rasukoo
34538	Anilkumar Chandrakant Kulkarni
34539	Rabindra Nath Mishra
34540	Gajanan Narayan Bhagwat
34541	Uma Shankar Singh
34542	Surendra Prasad Sinha
34543	Surya Narayan Mehta
34544	Dipak Sengupta
34545	Chitta Subrahmanyam
34546	Pramod Shridhar Mishall
34547	Mangal Deo Singh
34548	Ram Sharan Sinha
34549	Purna Nand Mishra
34550	Wudali Narasimhan
34551	K. V. Gopala Krishna Sastry
34552	Janagam Nageswar Rao
34553	Kandukuri Lakshmaiah
34554	Shashi Bhushan Prasad
34555	Kuldip Narain Tiwari
34556	Potlabathini Veeramallaiah
34557	Raghunandan
34558	Ramchandraiyer Jayaraman
34559	Shanti Kumar Chaudhary
34560	Vemuru Gopala Krishna Murty
34561	Pendyala Durgaprasad Rao
34562	C. K. Nanukuttan Nair
34563	Javvaji Atchaiah
34564	T. V. S. L. Narasimha Rama Rao
34565	Chiman Lal Waghray
34566	Dnyaneshwar Shankarrao Shukla
34567	Sarbjit Singh Gill
34568	Gerald T. Pais
34569	Gudur Ramaih Srinivasulu
34570	Prabhala Madan Mohan
34571	Alladi Sundarajan
34572	Mohammed Abdul Hameed Siddiqui
34573	Bapatla Panduranga Vithal Rao
34574	Chemitiganti Suryanarayana Sastry
34575	Mohammed Rafath Alam
34576	Krishnarao Raghoba Bodhmage
34577	Katta Sanjeeva Reddy
34578	Majjiga Venkata Sesha Reddy
34579	Harsukh Mohanlal Doshi
34580	Ram Sarup
34581	Cpl. S. Rajasekharam Nair
34582	Cpl. Padmanabhapillai Gopinathan Nair
34583	Cpl. Chittissery Thomas Mathai
34584	Kalarikal Savier Joseph
34585	Plamkoottathil Chacko Jacob
34586	Kundan Lal Mahajan
34587	Brahmakulamthekkathe Porinchu Jose
34588	Karanam Lakshmipathy
34589	Rajagopalnaidu Madhanagopal
34590	Gopalachari Ranganathan
34591	Ramachandran Balasubramanian
34592	Chakkilala Venkatesam
34593	Bhandaram Ananda Mohan
34594	Rachabattula Babu Rao
34595	Ganti Bala Prasada Rao
34596	Bangalore Badari Narayana
34597	Kommana Venkata Chalapathi Rao
34598	Hunganoor Krishnaiah Rangaswamy
34599	Satish Raj Malhotra
34600	Ayyagari Suryanarayana Murty
34601	Aekka Yadagiri Rao
34602	Yerrapalli Lakshmi Narasimha Rao
34603	Kalamalkuntla Sambasiva Reddy
34604	Devalla Sri Rama Rao
34605	Gururaj Shrinivas Rao Gunjikar
34606	B. Kanaka Mahalaxmi Prasada Rao
34607	Goli Linga Reddy
34608	Jeevi Narayana
34609	Muhammed Fazhullah Shrief

STUDENTS (*contd.*)

No.	Name	No.	Name
34610	Joseph J. Tharayil	34626	Subramaniyam Sanjeevi
34611	B. Govindarajulu	34627	Narayanaswamyraju Ramachandran
34612	Nataraja Viswanathan	34628	M. Viswanatha Krishnaswamy
34613	Lokanindi Narayana Rao	34629	Andhiudayar Govindasami
34614	P. S. Jayaraman	34630	Subramanian Ramamurthy
34615	D. Sankaranarayanan	34631	S. Subramanian
34616	Thanupillai Aiyappan Nair	34632	R. Subramanian
34617	Ramachandran Ramamoorthy	34633	Parakkal Rajagopal
34618	Kunnanath Pathiath Kunhiraman Nambiar	34634	Amirthalingam Angamuthu
34619	Hussain Mohammed Abdul Wahab	34635	S. Shanmuganathan
34620	Sokkalingam Ganapathy	34636	Rachakonda Rajagopal
34621	Ramanujam Parthasarathy	34637	Sankaralingam Sankarasubbu
34622	P. V. Balasubramanian	34638	A. R. Santhana Krishnan
34623	Krishnamoorthy Padmanabhan	34639	M. Sengottaiyamudaliar Mahalingam
34624	C. S. Thiagarajan	34640	Ramabhadran Hariharan
34625	Palayandoor Sundaram Kumaraswamy		

OBITUARY

The sympathy of the Institution is extended to the relative of those whose passing is recorded here

Maj. M. C. Pande

Maj. M. C. Pande, B.Sc. (Eng.), M.I.E., died on November 14, 1962, at the age of 62.

After graduation from the Banaras Hindu University securing B.Sc. (Eng.) degree in 1926, he worked as improver in the United Provinces Electric Supply Co. Ltd., Lucknow, for about a year till July 1927. Thereafter he was appointed as Assistant Professor of Electrical Engineering, Banaras Hindu University. In 1946, he was appointed Professor of Electrical Engineering. He specialized in electrical machine design and served the university in various capacities. He was a Major in the National Cadet Corps. Joining the Birla Institute of Technology, Ranchi, as its Principal in November 1954, he saw the Institute through its nascency and the difficult early years. His eight years of dedicated service put the Institute on a sound footing.

Maj. Pande joined the Institution as Associate Member in 1942 and was transferred to Member in 1953.

Shri W. J. Paul Raju

Shri W. J. Paul Raju, B.A., B.E., A.M.I.E., died on May 18, 1962.

After obtaining the B.A. degree of the Mysore University in 1929, and the B.E. degree in 1935 of the same University, he joined the Mysore Government Electrical Department in June 1935, where he was promoted to the position of an Inspector of Distribution Lines. He was posted as a Lecturer in Electrical Engineering, School of Engineering, Bangalore, in 1943 and was later appointed as Assistant Professor of Electrical Engineering in the College of Engineering, Bangalore, in July 1947, and held this position till his death.

Shri Paul Raju joined in the Institution as Associate Member in 1950.

Shri Rama Prasad Mukherjee

Shri Rama Prasad Mukherjee, B.Sc., B.C.E., A.M.I.E., died on July 9, 1962, at the age of 50.

After securing the B.C.E. degree from Patna University in 1939, he obtained the B.Sc. degree from the same university later. He joined the C. and W. Department, Government of Bengal, and after working for a year, he was appointed as Assistant Engineer in West Bengal Engineering Works in 1940. Subsequently, he worked with Cleaveland Bridge and Engineering Co. in the New Howrah Bridge project from 1941 to 1943. Having worked as Resident Engineer, Datt & Co., Calcutta, from 1944 to 1946, he practised as a Consulting Engineer for sometime, and then joined the Construction Board, Government of West Bengal, as Assistant Engineer in March 1950. He was later promoted to the rank of Executive Engineer. During his professional career, he was responsible for the layout of the new Howrah Bridge approach and many other works.

He joined the Institution as Associate Member in 1953.

Shri Satya Narain Singh

Shri Satya Narain Singh, B.Sc. (Eng.), A.M.I.E., died on October 20, 1962, at the age of 41.

Having obtained the B.Sc. (Eng.) degree of the Patna University in 1943, he was appointed in 1945 as an Assistant Engineer in the Jaipur State P.W.D., renamed later as P.W.D., Buildings and Roads, Government of Rajasthan. He rose to the rank of an Executive Engineer, Buildings and Roads, P.W.D., Rajasthan, which office he held until his death. He was responsible for the design and construction of important Government buildings and roads and bridges.

He joined the Institution as Associate Member in 1954.

EMPLOYMENT SERVICE

This service is intended for the benefit of members of the Institution and for the Government, industrial and other organizations employing engineers. It is hoped that the employers will make full use of this service to obtain their requirement.

A small charge of Rs. 5 per insertion will be made to members for notices appearing in the 'Situations Wanted' column.

In the 'Situations Vacant' column a charge of Rs. 2 per line will be made.

Replies to advertisements should be addressed to Employment Service, The Institution of Engineers (India), P. O. Box No. 669, Calcutta 20, except where otherwise stated.

SITUATIONS VACANT

BEEGEE CORPORATION PRIVATE LTD., 25 Factory Area, Patiala, is interested in design and production engineers for :

1. Various types of electric motors and alternators ;
2. H.T. and L.T. switchgear ;
3. Transformers (Power and Distribution),
4. Structural Fabrication Engineer ;
5. Hot Dip Galvanising Expert ; and
6. Foundry Expert, more precisely Metallurgist, suitable for organizing cast iron and malleable cast iron foundry.

WANTED on work charged establishment Works Supervisors with minimum 5 years experience in building construction. Experience in levelling, layouts, taking measurements and preparing bills essential. Apply with copies of testimonials and minimum salary expected to A. F. Cama, Resident Engineer, N.B.C.C. Ltd., 129, Malviya Nagar, Bhopal (M.P.)

SITUATIONS WANTED

CHEMISTRY GRADUATE, age 23, passed Sections A and B examinations of the Institution of Engineers (India) with chemical engineering subjects, having three years experience in chemical engineering field, likes to make production/industrial engineering as a career and seeks suitable change (Office ref. E.S. 114)

QUALIFIED MECHANICAL ENGINEER, B.Sc., V.D.I. (Germany), Grad.I.E., specialized from continent in design and manufacture of mechanical handing equipment like cranes, conveyors, elevators, etc., also worked in an Indian railway workshop and capable of working independently, seeks suitable post (Office ref. E.S. 115)

THE INSTITUTION OF ENGINEERS (INDIA)
8 Gokhale Road, Calcutta 20
May 1963 Examinations

Programme

Days	S.T. 10.00 to 1.00	S.T. 2.00 to 5.00
	Studentship Examination	
Monday, May 6, 1963	English	Mathematics I
Tuesday, May 7, 1963	Mathematics II	Physics
Wednesday, May 8, 1963	Chemistry	
	Associate Membership Examination—Section A	
Monday, May 6, 1963	Mathematics I	Mathematics II
Tuesday, May 7, 1963	Applied Mechanics	Principles and Applications of Heat, Light and Sound
Wednesday, May 8, 1963	Principles and Applications of Electricity	Theory of Structures and Strength of Materials Theory of Machines Elementary Electrical Engineering Applied Chemistry Physical Chemistry and Organic or Inorganic Chemistry
	Associate Membership Examination—Section B	
Monday, May 6, 1963	Engineering Materials	Engineering Drawing I
Tuesday, May 7, 1963	Engineering Drawing II (from 10.00 a.m. to 1.00 p.m. and 1.30 p.m. to 4.00 p.m.)	
Wednesday, May 8, 1963	Theory and Design of Structures Diffusional Processes, Evaporation and Distillation Chemical Works Organization and Management	Electrical Engineering General Geology Fuels and Combustion
Thursday, May 9, 1963	Irrigation Water Supply and Sanitary Engineering Hydro-Electricity Agricultural Engineering Machine Design Mining Metallurgy Mechanics of Fluids	Thermodynamics and Heat Engines Metallurgy Transport and Storage of Materials Principles of Heat Transmission and Furnaces Soil Mechanics and Foundation Engineering
Friday, May 10, 1963	Workshop Technology Engineering Chemistry Electrical Installations Electrical Measurements Electric Traction Ultra-High Frequency Technique Including Radar and Centimeter-Waves Electro-Chemistry Industrial Stoichiometry	Building Construction Stability and Resistance of Ships Gas Engineering Principles of Mining Metrology and Machine Tools Electricity Supply Instruments and Automatic Control in Chemical Industry Chemical Works Design and Construction Size Reduction, Mixing and Separation
Saturday, May 11, 1963	Hydraulics and Hydraulic Machinery Roads Town Planning Harbours and Docks Architecture Line Communication Railways Power Generation and Distribution in Chemical Works	Electrical Machinery Geodesy Radio Communication Principles of Heat Transmission. Heat Transfer Equipment and Refrigeration Materials and Mechanical Construction of Chemical Plants
Monday, May 13, 1963	Industrial Engineering and Management	Refrigeration and Air-Conditioning Aeronautics

Form 362

THE INSTITUTION OF ENGINEERS (INDIA)

8 Gokhale Road, Calcutta 20

May 1963 Examinations

General information and instructions to candidates

(Approved by the Examinations Committee, 51st Meeting, Resolution 21, 30th December, 1958)

(Revised by the Examinations Committee, 57th Meeting, Resolution 19, 27th-29th June, 1961; and 58th Meeting, Resolution 10, 13th and 14th October, 1961)

(1) The next Studentship and Associate Membership (Sections A and B) Examinations will be held from Monday, May 6, 1963 to Monday, May 13, 1963 both days inclusive. The application forms for the Associate Membership (Sections A and B) Examination and the programme of examinations are attached to this *Bulletin*.

(2) **All applications accompanied by examination fees for admission to the May 1963 examinations should reach the Head Office before 4 p.m. on Friday, March 15, 1963.** Examination fees once paid are neither refundable nor transferable to a subsequent examination or to any other account, Receipt of examination forms will not be acknowledged by the Head Office, unless accompanied by a self-addressed post-card.

(3) **Examination fees should be preferably deposited at the State Bank of India in the candidates' locality. Attention of the candidates is specially drawn to item 4 in Form 304 (rev. 8) and item 5 in Form 305 (rev. 7) in this regard. The instructions for making such payment are given in card A (attached herewith) and on its reverse. Other modes of payment may be used only if this is not possible. Payment of examination fees by cheque will not be accepted.**

(4) No application for a change of examination centre will be entertained after 4 p.m. on Friday, March 15, 1963.

(5) Students who are in arrears of subscription will not be admitted to the examinations.

(6) **The Institution reserves the right to reject incomplete or illegible applications without any reference to the candidate.**

(7) No Student will be permitted to appear in the Section B examination unless he has fully passed the Section A examination or secured exemption therefrom. A candidate for the Section B examination should therefore mention the year in which he passed the Section A examination.

(8) Students appearing for the Section B examination under the revised rules 11.2.1 to 11.2.9 of the rules of examinations (see 'Rules and Syllabuses of Studentship and Associate Membership Examinations') should clearly state in the application form the name of the Local Centre to which they are attached.

(9) A candidate who has already passed the Section A and B examinations or is exempted therefrom will be permitted to appear in any paper or papers of Section A and/or Section B on payment of an examination fee of Rs. 30.00 per paper. The details of passing the Section A and B examinations or of exemption therefrom should be clearly stated in the examination form, with the grade of membership.

(10) The paper in 'Engineering Drawing II' is of 5½ hours' duration, with a half-hour recess between. Candidates will not, however, be permitted to leave the examination hall.

(11) Section B candidates should specially note to write down on the cover of their answer-books of the paper in 'Engineering Drawing II' the names of their particular sections, *viz.* structural steelwork or reinforced concrete or machines or electrical or chemical plant.

(12) **Candidates are not permitted to use handbook(s) for the paper in 'Engineering Drawing II'. They may however use steel tables of the Dorman-Long type.**

(13) Candidates detected using unfair means in the examination hall will be expelled from the Institution and will not be readmitted to the Institution at any future time.

(14) Candidates reappearing in subject(s) in which they have already secured exemption(s), will have their paper(s) cancelled. The previous exemption(s) will stand.

(15) It is sometimes found that candidates do not enter their Studentship Number/Studentship Application Reference Number, Roll Number, or other necessary particulars on the answer-books. Such answer-books will be rejected and no attempt will be made to locate the candidates. Candidates should therefore take particular care to write down these particulars on the answer-books correctly.

(16) **The results of the May 1963 examinations will be declared before the last day of August 1963.**

(17) Applications for revaluation of answer-books will not be entertained.

(18) After the declaration of results, the marks of each examination will be communicated to candidates on application and on advance payment of Rs. 5.00.

(19) **The Institution reserves the right to cancel the result of any candidate without assigning reasons, in which case, the marks will not be supplied.**

(20) In any future correspondence in regard to the May 1963 examinations, candidates should always mention the Section of the Associate Membership Examination in which they appeared and their centre of examination in May 1963

THE BULLETIN
OF
The Institution of Engineers (India)

SECRETARY & EDITOR: B. Seshadri, B.Sc., A.I.I.Sc., D.I.C., M.Sc.(Eng.), M.I.E.

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No. AGM 43

The Institution of Engineers (India)

8 Gokhale Road, Calcutta 20

February 28, 1963

The Forty-Third Annual General Meeting of the Institution of Engineers (India) will be held at the Puttanna Chetty Hall, Bangalore, on Saturday, May 18, 1963, at 3.00 p.m.

AGENDA

1. To confirm the minutes of the Forty-Second Annual General Meeting (circulated in the March 1962 issue of the *Bulletin* of the Institution, pages 9-24).
2. To confirm the minutes of the Meeting of Corporate Members held in New Delhi on 31st March, 1962, to consider revisions to Regulation 19 on the subject of annual subscriptions (circulated in the June 1962 issue of the *Bulletin* of the Institution, pages 24-29).
3. To receive the Annual Report of the Council (printed in abstract in the February 1963 issue of the *Bulletin* of the Institution, pages 20 to 28) and the Audited Accounts (circulated in the January 1963 issue of the *Bulletin* of the Institution) for the year ended August 31, 1962.
4. To receive the report of the Council on the election for 1962-63 of (i) The President, and (ii) The Vice-Presidents.
5. To appoint Auditors for the year 1962-63 and to fix their remuneration.
6. To consider any other business which may be brought forward with the permission of the Chair.

B. Seshadri
Secretary

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* Copy of the full Annual Report will be available on application to the Secretary in writing.

PROGRAMME

forty-third annual convention

BANGALORE
MAY 18-25, 1963

43RD ANNUAL CONVENTION
BANGALORE
MAY 18-25, 1963

The 43rd Annual Convention will take place in Bangalore between May 18 and 25, 1963.

The Mysore Centre of the Institution will be the hosts on the occasion, and are making the necessary arrangements for a successful Convention and to make the stay of the delegates as enjoyable as possible.

The revised programme is printed below.

Attention is particularly invited to the fact that the outstation tours have been restored and will now take place as shown in the programme. Rail concession had been withdrawn by the Railway Board due to the National Emergency but efforts are being made to secure the concession for members attending the Convention. If these are successful, notification will be made.

THE ANNUAL GENERAL MEETING

Business Session

The Business Session of the 43rd Annual General Meeting will be held at 3.00 p.m. on Saturday, May 18, 1963, at the Puttanna Chetty Hall, Sri Jayachamarajendra Road, Bangalore.

Inaugural Session

The Inaugural Session of the 43rd Annual General Meeting will be held at 9.30 a.m. on Sunday, May 19, 1963, at the Rabindra Nataka Mandir, Sri Jayachamarajendra Road, Bangalore.

Paper Meetings and Symposia

Paper Meetings and Symposia will be held at the Rabindra Nataka Mandir, Puttanna Chetty Hall, and the Haigh Memorial Hall on Monday, May 20, and Tuesday, May 21, 1963, and the detailed schedule is given at the end of this programme.

PROGRAMME

Thursday, May 16, and Friday, May 17, 1963

12.00 noon to 5.00 p.m.	Registration of local members at the Institution Office at Vidhana Veedhi (near Vidhana Soudha), Bangalore

Saturday, May 18, 1963

9.00 a.m. to 1.00 p.m. and 2.00 p.m. to 4.00 p.m.	Registration of outstation members at Rabindra Nataka Mandir
10.00 a.m.	Adjourned Meeting of the 1961-62 Council
3.00 p.m.	Business Session of the 43rd Annual General Meeting at Puttanna Chetty Hall
5.00 p.m. to 5.30 p.m.	Tea
5.30 p.m.	Meeting of Flood Control Committee
5.30 p.m. to 6.30 p.m.	Students' Session at Puttanna Chetty Hall

Sunday, May 19, 1963

9.30 a.m. to 11.00 a.m.	Registration of outstation members at Rabindra Nataka Mandir
9.30 a.m.	Inaugural Session of the 43rd Annual General Meeting at Rabindra Nataka Mandir
10.30 a.m.	Tea
11.15 a.m.	Sixth Sir M. Visvesvaraya Lecture by Dr. A. N. Khosla, Governor of Orissa
1.00 p.m.	Lunch at the pavilion adjacent to Rabindra Nataka Mandir
2.00 p.m to 3.00 p.m.	Meeting of Engineering Research Committee
3.00 p.m.	Popular Lecture; 'Sixth World Power Conference and My Visit to Australia' by Prof. M. V. Deshpande (M.)
8.00 p.m.	Annual Dinner at Lal Bagh, Bangalore

Monday, May 20, 1963

9.00 a.m. to 1.00 p.m. (with Tea at 11.00 a.m.)	Address by Chairmen and Symposia and Paper Meetings
1.00 p.m.	Lunch at the pavilion adjacent to Rabindra Nataka Mandir
2.00 p.m. to 5.00 p.m.	Paper Meetings
6.45 p.m. to 8.00 p.m.	Cultural Show at Rabindra Nataka Mandir

Tuesday, May 21, 1963

9.00 a.m. to 1.00 p.m.	Symposia and Paper Meetings
1.00 p.m.	Lunch at the pavilion adjacent to Rabindra Nataka Mandir

2.00 p.m. to 4.00 p.m.	Symposia and Paper Meetings
4.00 p.m. to 5.30 p.m.	Closing Session
6.00 p.m.	Tea
6.45 p.m. to 8.00 p.m.	Cultural Show at Rabindra Nataka Mandir

Wednesday, May 22, 1963

8.00 a.m. to 1.00 p.m.	Visit to Indian Telephone Industries and Hindustan Aircraft (other than Council Members). Return to hotels for Lunch
9.00 a.m.	Meeting of the 1962-63 Council
2.00 p.m. to 3.00 p.m.	Meeting of Engineering Education Committee
3.00 p.m.	Visit to Sir M. Visvesvaraya Industrial Museum, Cubbon Park, Lal Bagh, and drive round Bangalore

The charge for the above trip will be Rs. 5 per head.

OUTSTATION TOURS

The following outstation tours have been arranged. Delegates are requested to select one out of them. As the number of delegates that can be accommodated in each tour is limited, the allocation of tours for the delegates will be according to priority of registration. Registration will be made only on receipt of full payment. Delegates will have to bring their own bedding for all the tours.

Tour No. 1(a)

May 23, 1963	Leave Bangalore for Bhadravati, reaching Bhadravati at 12.30 p.m. Lunch at Bhadravati. Visit Bhadra Reservoir Project and return to Bhadravati and halt for the night.
May 24, 1963	Visit to Mysore Iron and Steel Works and Paper Mills. Halt for the night at Bhadravati.
May 25, 1963	Leave for Jog at 7.00 a.m. Visit Linganamukki and Talakalale Dams and Generating Station site. Lunch in the afternoon. Dinner at Jog and rest for the night at Jog.
May 26, 1963	Leave for Bangalore at 8.00 a.m. Lunch at Arsikere, Reach Bangalore by 5.00 p.m.

Tour No. 1(b)

May 23, 1963	Leave Bangalore at 7.00 a.m. for Jog, reaching Jog at 5.00 p.m. Rest for the night.

May 24, 1963	Visit to Linganamukki and Talakalale Dams and Generating Station site. Lunch in the afternoon. Dinner at Jog. Rest for the night.
May 25, 1963	Leave for Bhadravati at 7.00 a.m. Visit to Mysore Iron and Steel Works and Paper Mills between 2.00 and 5.00 p.m. Rest for the night.
May 26, 1963	Leave for Bhadra Reservoir at 8.00 a.m. Inspect Bhadra Reservoir. Lunch at Arsikere. Reach Bangalore at 5.00 p.m.

Tour No. 2

May 23, 1963	Leave Bangalore at 7.00 a.m. for Tungabhadra. Lunch at Marikanive and reach Tungabhadra. Rest for the night.
May 24, 1963	Visit to Tungabhadra Steel Products between 8.00 and 10.00 a.m. Visit to Humpi between 1.00 and 5.00 p.m. Return to Munirabad at 6.00 p.m. and visit Tungabhadra Dam. Rest for the night.
May 25, 1963	Leave Munirabad at 8.00 a.m. for Harihar, reaching Harihar at 10.30 a.m. Visit to Mysore Kirloskars ; Lunch at Kirloskars at 12.30 p.m. Leave Harihar and reach Bangalore by 7.00 p.m.

Tour No. 3

May 23, 1963	Leave for Shimsha at 7.00 a.m. Lunch at Shimsha. Leave for Bandipur, visiting Somanathapura on the way. Dinner and rest for the night at Bandipur.
May 24, 1963	Visit to Game Sanctuary between 6.00 and 9.00 a.m. Leave for Krishnarajasagar at 10.00 a.m. after Breakfast. Visit to Krishnarajasagar Research Station between 4.30 and 6.30 p.m. See Illuminations from 6.30 to 8.00 p.m. Dinner at Krishnarajasagar and leave for Mysore. Rest for the night at Mysore.
May 25, 1963	Visit to places of interest in Mysore from 8.00 a.m. to 12.00 noon. Leave Mysore after Lunch, reaching Bangalore at 6.00 p.m.

Tour No. 4

May 23, 1963	Leave Bangalore for Mysore at 7.00 a.m. Visit to Srirangapatna on the way. Lunch at Mysore ; drive round Mysore. Leave for Krishnarajasagar at 4.30 p.m. Visit to Krishnarajasagar Research Station from 5.00 to 6.30 p.m. See Illuminations from 6.30 to 8.00 p.m. Dinner at Krishnarajasagar. Rest for the night at Mysore.

May 24, 1963 Leave Mysore for Belur at 7.00 a.m. Lunch at Belur. Visit to Belur and Halebid Temples. Halt for the night at Hassan.

May 25, 1963 Leave Hassan at 7.00 a.m. for Sravanabelagola. Proceed to Bangalore after Lunch at Marikanive, reaching Bangalore at 7.00 p.m.

General Notes

1. **Registration fee**

Corporate Members and Graduates	...	Rs. 15.00 each
Students	...	Rs. 8.00 each

2. **Annual Dinner**

Corporate Members, Graduates and their Gentlemen Guests	...	Rs. 15.00 each
Students	...	Rs. 10.00 each
Lady Guests	...	Rs. 10.00 each

3. **Visits**

Local	...	Rs. 5.00 per participant
Outstation	..	Rs. 90.00 per participant for one tour only

4. **Transportation**

A consolidated charge of Rs. 5.00 will be levied for each delegate availing the transportation arrangements made by the Mysore Centre during the Convention; exclusive of the charge for local visits. The above charge includes conveyance from railway station to place of lodging and from place of lodging to various meeting places, etc.

5. **Ladies' programme**

A separate programme for ladies accompanying members is being arranged and a charge of Rs. 10.00 will be collected from each lady accompanying a delegate. This will include all the facilities arranged during the Annual Convention, including the special tours arranged for ladies but excluding the Annual Dinner, outstation tours and hotel charges.

6. **Arrangements for return journey**

Reservation for the return journey of the delegates will be arranged, if the exact date of departure to their places of destination is intimated sufficiently in advance. M/s. Thos. Cook & Son, 20-C, Mahatma Gandhi Road, Bangalore 1, are in charge of these arrangements. They will charge their usual service charge of Rs. 5.00 per ticket for this facility.

LADIES' PROGRAMME

May 18, 1963

9.00 a.m. to 1.00 p.m.	Registration and presentation of gifts and badges at Puttanna Chetty Hall
3.00 p.m. to 5.00 p.m.	Conducted Shopping Tour
5.00 p.m. to 5.30 p.m.	Tea

May 19, 1963	
9.30 a.m.	Inaugural Session
10.30 a.m.	Tea
11.00 a.m. to 1.00 p.m.	Visit to Cubbon Park and Lal Bagh
1.00 p.m.	Lunch
8.00 p.m.	Annual Dinner
May 20, 1963	
9.00 a.m.	Leave for Nandi Hills. Lunch at Nandi Hills and return to Bangalore by 5.00 p.m.
6.00 p.m.	At Home
6.45 p.m. to 8.00 p.m.	Cultural Show
May 21, 1963	
9.00 a.m.	Leave for Chamarajasagar Water Works; Lunch at Chamarajasagar Water Works
3.00 p.m.	Return to Bangalore
6.00 p.m.	Tea
6.45 to 8.00 p.m.	Cultural Show
May 22, 1963	
9.00 a.m. to 1.00 p.m.	Visit to Ladies Organizations at Bangalore
3.00 to 6.00 p.m.	Conducted Shopping Tour
May 23, 1963	
7.00 a.m.	Leave for Outstation Tours

GRANT OF CASUAL LEAVE FOR GOVERNMENT OFFICERS ATTENDING MEETINGS OF SCIENTIFIC ASSOCIATIONS

An extract from Notifications No. 74(4)/-50-SR.III dated July 29, 1951, printed in the *Bulletin*, vol. I, no. I, September 1951, p. 28, and No. 27(7)/53 -SR.III dated December 10, 1953, printed in the *Bulletin*, vol. 3, no. 3, March 1954, p. 14, issued by the Ministry of Natural Resources and Scientific Research, Government of India, in regard to the grant of casual leave to such officers as desire to attend meetings of scientific associations is reproduced below for information :

'......................subject to the exigencies of Government business, Government servants who are invitees, members, official delegates of the organization concerned or have been asked to read papers at a conference may be given facilities to attend meetings organized by scientific associations like the Indian Science Congress Association, The National Institute of Sciences of India, The Institution of Engineers (India), The Indian Academy of Sciences, Bangalore, and other similar bodies, by the grant to them of special casual leave to the extent required for attendance at the meetings and for journeys to and from the places of meeting. It is requested that if there is no objection, requests from individual Government servants for leave to attend meetings of scientific associations may be disposed off in the light of this decision'.

PROGRAMME OF PAPER MEETINGS AND SYMPOSIA

The programme of the Paper Meetings and Symposia to be held during the Annual Convention between May 18-25, 1963, is given below.

Engineering Division/ Group	May 20, 1963		May 21, 1963	
	9.00 a.m. to 1.00 p.m.	2.00 p.m. to 5.00 p.m.	9.00 a.m. to 1.00 p.m.	2.00 p.m. to 4.00 p.m.
Civil	Paper Meetings		Symposium	
Mechanical	Symposium			
Electrical		Paper Meetings	Symposium	
General		Paper Meetings		Symposium
Chemical			Paper Meetings	
Electronics and Telecommunication	Paper Meetings			
Mining and Metallurgy	Paper Meetings			
Public Health		Paper Meetings		
Structures Group 1		Paper Meetings		
Structures Group 2	Paper Meetings			
Roads and Road Transportation		Paper Meetings		
Industrial Engineering		Paper Meetings		
Marine Engineering and Shipbuilding	Paper Meetings			

The Chairs of the Railway Engineering, Aeronautical Engineering, and Nuclear Engineering Groups are vacant at present and there are no papers for discussion in the first two Groups. A paper received for presentation in the Nuclear Engineering Group is included in the Paper Meetings of the General Engineering Division on May 20, 1963.

Schedule for Paper Meetings and Symposia

May 20, 1963, 9.00 a.m. to 1.00 p.m.

Civil Engineering Division

Paper Meetings

(1) Address by Prof. N. S. Govinda Rao (*M.*), *Chairman*

(2) 'Foundation Exploration at Nagarjunasagar Dam' by R. C. Rao (*A.M.*) (*Journal*, vol. 42, no. 7, pt. CI 4, March 1962)

(3) 'Plant Selection and Layout with Special Reference to Rihand Dam' by A. N. Rau (*A.M.*) (*Journal*, vol. 42, no. 7, pt. CI 4, March 1962)

(4) 'Hydraulic Jump Stabilization' by K. Seetharamiah (*M.*) and A. S. Ramamurti (*Non-member*) (*Journal*, vol. 42, no. 7, pt. CI 4, March 1962)

(5) 'Determination of the Elements of Hydraulic Jump in Trapezoidal Channels' by Prof. R. M. Advani (*M.*) (*Journal*, vol. 42, no. 9, pt. CI 5, May 1962)

(6) 'The Port of Calcutta—Problems and Solution' by D. Mookerjea (*M.*) (*Journal*, vol. 42, no. 11 pt. CI 6, July 1962)

(7) 'Planning for Flood Control Legislation' by Moshin Ali (*Life Member*) (*Journal*, vol. 42, no. 11, pt. CI 6, July 1962)

(8) 'Design of Reinforced Concrete by Plastic Theory' by (*Shrimati*) Shakuntala Bhagat (*A.M.*) (*Journal*, vol. 43, no. 3, pt. CI 2, November 1962)

Mechanical Engineering Division

(1) Address by Shri T. R. Gupta (*M.*), *Chairman*

(2) Symposium on 'Automation in Industry'

Electronics and Telecommunication Engineering Division

Paper Meetings

(1) Address by Dr. A. K. Chatterjee (*M.*), *Chairman*

(2) 'Telecommunication Networks on Indian Railways—Progress and Problems' by B. V. Sreenivasiah (*A.M.*) (*Journal*, vol. 42, no. 9, pt. ET 3, May 1962)

(3) 'Transistor *R-C* Oscillators' by V. P. Sinha (*Non-member*) (*Journal*, vol. 42, no. 5, pt. ET 2, January 1962)

(4) 'Simulation of Third Order Systems with a Lead and a Time Constant Using One Operational Amplifier' by L. K. Wadhwa (*Non-member*) and H. S. Rao (*Non-member*) (*to be published*)

(5) 'Simulation of Third Order Systems with One Operational Amplifier' by G. K. Aggarwal (*Non-member*) and L. K. Wadhwa (*Non-member*) (*Journal*, vol. 43, no. 5, pt. ET 2, January 1963)

(6) 'Telegraph Codes for Phonetic English Alphabet' by S. Balaram Rao (*A.M.*) and S. Raghunatha Rao (*Non-member*) (*to be published*)

Mining and Metallurgy Division

Paper Meetings

(1) Address by Dr. M. N. Dastur (*M.*), *Chairman*

(2) 'A Discussion on the Reduction of Silicon Dioxide in Blast Furnace' by A. T. Pal (*A.M.*) (*Journal*, vol. 42, no. 11, pt. MM 3, July 1962)

(*Further details to be announced later*)

Structures Group—2 : Shell Structures

Paper Meetings

(1) Address by Shri G. S. Ramaswamy (*M.*), *Chairman*

(2) 'Plano-Concave Shells' by M. N. Keshava Rao (*Non-member*) (*to be published*)

(3) 'Analysis of a Shallow Funicular Shell by the Method of Finite Differences' by B. S. Phadke (*A.M.*) and V. P. Apte (*A.M.*) (*to be published*)

(4) 'Experimental Analysis of a Continuous Cylindrical Shells' by S. P. Sharma (*Non-member*), R. Das Gupta (*Non-member*), and K. S. Shishodia (*Non-member*) (*to be published*)

Marine Engineering and Shipbuilding Group

Paper Meetings

(1) Address by Shri S. Basu (*M.*), *Chairman*

(*Details to be announced later*)

May 20, 1963, 2.00 p.m. to 5.00 p.m.

Electrical Engineering Division

Paper Meetings

(1) Address by Prof. M. V. Deshpande (*M.*), *Chairman*

(2) 'Design of Electrical Power Machines' by S. H. Raj (*A.M.*) (*Journal*, vol. 42, no. 6, pt. EL 3, February 1962)

(3) 'Possible Criteria for Determining the Condition of Lightning Arresters' by V. Prabhashanker (*Non-member*), S. S. Hubli (*Non-member*), and Prof. D. J. Badkas (*A.M.*) (*Journal*, vol. 42, no. 8, pt. EL 4, April 1962)

(4) 'Some Aspect of Electrical Development in Andhra Pradesh' by B. P. Sastry (*A.M.*) (*Journal*, vol. 42, no. 8, pt. EL 4, April 1962)

(5) 'Predetermination of Electrical Characteristics of Steel Tubes at Power Frequencies—I' by Dr. H. R. Chablani (*A.M.*) (*Journal*, vol. 42, no. 10, pt. EL 5, June 1962)

(6) 'Some Research Problems in Electrical Apparatus' by Prof. M. V. Deshpande (*M.*) (*Journal*, vol. 42, no. 10, pt. EL 5, June 1962)

(7) 'Analysis of A.C. Magnetic Field in the Nonlinear Region at Very Low Frequencies' by R. C. Pal (*A.M.*) (*Journal*, vol. 42, no. 12, pt. EL 6, August 1962)

General Engineering Division

Paper Meetings

(1) Address by Shri R. N. Joshi (*M.*), *Chairman*

(2) 'Apprenticeship Training in Industry' by Dr. N. S. Nandeeswaraiya (*M.*) (*Journal*, vol. 42, no. 8. pt. GE 2, April 1962)

(3) 'Scheme of Cost Reduction' by T. S. Vedagiri (*Non-member*) (*Journal*, vol. 42, no. 8. pt. GE 2, April 1962)

(4) 'Management and Administration of Engineering Activities and Their Impact on the Country's Development Programme' by Prof. R. M. Advani (*M.*) (*Journal*, vol. 42, no. 12, pt. GE 3, August 1962)

(5) 'Efficiency in Civil Engineering' by Richard Pfenniger (*M.*) (*Journal*, vol. 42, no. 12, pt. GE 3, August 1962)

(6) 'Steam Cycle Analysis for Nuclear Power Reactor' by S. K. Biswas (*A.M.*)* (*to be published*)

Public Health Engineering Division

Paper Meetings

(1) Address by Shri R. S. Mehta (*M.*), *Chairman*

(2) 'Methods of Disposal of Radioactive Wastes' by M. Ansari (*A.M.*) (*Journal*, vol. 42, no. 5, pt. CI 3, January 1962)

(3) 'A Comparative Study of the M.P.N and Membrane Filter Techniques for Bacteriological Examination of Drinking Water' by Prof. S. J. Arceivala (*A.M.*) and R. Pitchai (*A.M.*) (*Journal*, vol. 42, no. 11, pt. 16, July 1962)

(*Further details to be announced later*)

Structures Group I—Prestressed Concrete Development

Paper Meetings

(1) Address by Shri N. N. Purandare (*M.*), *Chairman*

(*Details to be announced later*)

Roads and Road Transportation Group

Paper Meetings

(1) Address by *Chairman*†

(2) 'Dense Graded Asphaltic Paving Mixture by K. S. Sankaran (*A.M.*) (*Journal*, vol. 42, no. 9, pt. CI 5, May 1962)

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* This paper is included for discussion in the General Engineering Division as the Chair of the Nuclear Engineering Group is vacant at present.

† The name will be announced later.

(3) 'A Study of Indian Blast Furnace Slag as Road Aggregate by I. P. Khanna (*Non-member*) and V. Venkatasubramanian (*A.M.*) (*Journal*, vol. 42, no. 11, pt. CI 6, July 1962)

(4) 'Subgrade Theories in Design of Concrete Pavements' by N. K. Vaswani (*A.M.*) (*Journal*, vol. 42, no. 9, pt. CI 5, May 1962)

(5) 'Traffic Accidents and Their Specific Problems in Assam' by G. C. Sharma (*M.*) (*Journal*, vol. 43, no. 5, pt. CI 3, January 1963, and no. 7, pt. CI 4, March 1963)

Industrial Engineering Group

(1) Address by Shri R. M. Patri (*M.*), *Chairman*

(2) 'Use of Time Span Instrument in Job Analysis and Measurement of of Responsibility' by Prof. R. Mishra (*M.*) and R. Banerjee (*Non-member*) (*Journal*, vol. 42, no. 8, pt. GE 2, April 1962)

(3) 'Comparative Evaluation of Fundamental Motion-Time Systems' by N. K. Datta (*A.M.*) (*Journal*, vol 42, no. 12, pt. GE 3, August 1962)

(4) 'Occupational Health Research in India with Special Reference to Psychological Research' by H. C. Ganguli (*Non-member*) (*to be published*)

(5) 'Performance Sampling Study of Long Cycle Repetitive Jobs' by Stephenos (*Non-member*) and N. K. Datta (*A.M.*) (*Journal*, vol. 43, no. 4, pt. GE 1, December 1962)

May 21, 1963, 9.00 a.m. to 1.00 p.m.

Symposium on 'Engineering Construction and Materials'

Electrical Engineering Division

Symposium on 'Analogies in Engineering'

(1) 'The Electronic Analogue Computer as an Aid in the Analysis of Electrical Machines' by Dr. R. E. Bedford (*A.M.*) and S. K. Mukerji (*Non-member*)

(2) 'Thermal Circuit Analysis of Unconditioned Buildings' by C. L. Gupta (*Non-member*), and B. C. Roychaudhury (*Non-member*)

(3) 'A D.C. Negative Resistance Circuit and Its Use in Electrical Analogues' by P. V. Indiresan (*Non-member*)

(4) 'Model Tests for Grounding Systems' by Prof. H. N. Ramachandra Rao (*M.*) and T. Nookia Chetty (*Non-member*)

(5) 'Hydraulic Analysis of Pipeline Networks by Direct Electrical Analogy Method' by V. Raman (*A. M.*) (*Journal*, vol. 42, no. 9, pt. CI 5, May 1962)

(6) 'Analogue Methods in Electromagnetic Field Problems' by Dr. V. Subba Rao (*A.M.*)

Chemical Engineering Division

(1) Address by Dr. V. M. Dokras (*M.*), *Chairman*

(2) 'Adiabatic Extrusion of Thermoplastics' by Prof. M. V. Joshi (*A.M.*) and K. A. T. Varghese (*Non-member*) (*Journal*, vol. 42, no. 6, pt. CH 2, February 1962)

(3) 'Introduction of Two Basic Factors (Q_a and T_c) in the Design of Combustion Furnaces' by A. K. Shaha (*M.*) (*Journal*, vol. 42, no. 6, pt. CH 3, June 1962)

(4) 'Study of Primary Air Entrainment in Gas Jet Burners' by G. S. Davies (*Non-member*) and S. G. Mukherjee (*Non-member*) (*Journal*, vol. no. 2, pt. CH 1, October 1962)

May 21, 1963, 2.00 p.m. to 4.00 p.m.

General Engineering Division

Symposium on 'Some Aspects of Engineering Education : (i) Do We Need More Engineering Colleges? (ii) Fits and Misfits Amongst Engineering Students ; (iii) Desirability of Assessment of Term Work in Engineering Institutions ; and (iii) Suggestions on Reorientation of Technical Education in View of the Present National Emergency'

(1) 'Improving Standards and Minimizing Wastage in Technical Education' by Prof. R. M. Advani (*Member*)

(2) 'Engineering, Technology and Science' by R. S. Barve (*A.M.*)

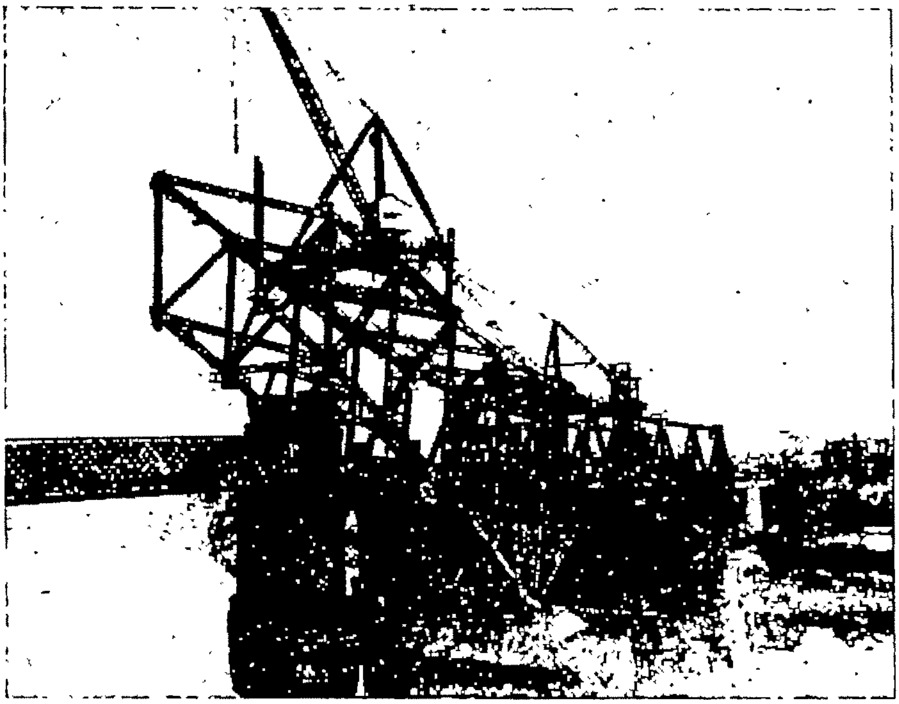
(3) 'Some Aspects of Engineering Education' by P. V. Bhat (*M.*)

(4) 'Term Work and Engineering Examinations' by M. V. Joshi (*A. M.*)

(5) 'Some Aspects of Engineering Education' by Brig. N. Sen Gupta (*M.*)

(6) 'Desirability of Assessment of Term Work in Engineering Examinations' by B. D. Shiwalkar (*A. M.*)

the 1,500 ft. Runcorn Approach to the bridge starts. The approach northwards from the main bridge to Church Street, Widnes, is 1,092 ft. long and from this point, the extension of the Widnes Approach to Ditton Road commences, for which scheme the Lancashire County Council was responsible. The approach viaducts consist in the main of reinforced concrete spans, averaging about 78 ft. in length. The piers are of T-shaped sections which support reinforced concrete beams and decking. Steel plate girder spans are provided for crossing the Bridgewater Canal and the High Street in Runcorn and in the spans immediately adjacent to the main bridge. The Runcorn Approach viaduct is 1,308 ft. long and that at Widnes 585 ft. To make way for the bridge and the Runcorn Approach viaduct, 120 houses, two public houses and two garages were demolished by the Cheshire County Council. Through the Runcorn U.D.C., the County Council has built two housing estates at Windsor Grove and Penn Lane, Runcorn, to re-house the families displaced by demolition of their homes.



Widnes main bridge arch erection in progress

Further Parliamentary powers were obtained in 1955 and a contract was let to Leonard Fairclough Ltd., Adlington, for the construction of the foundations of the main bridge. Work was started in May 1956, and included the following:

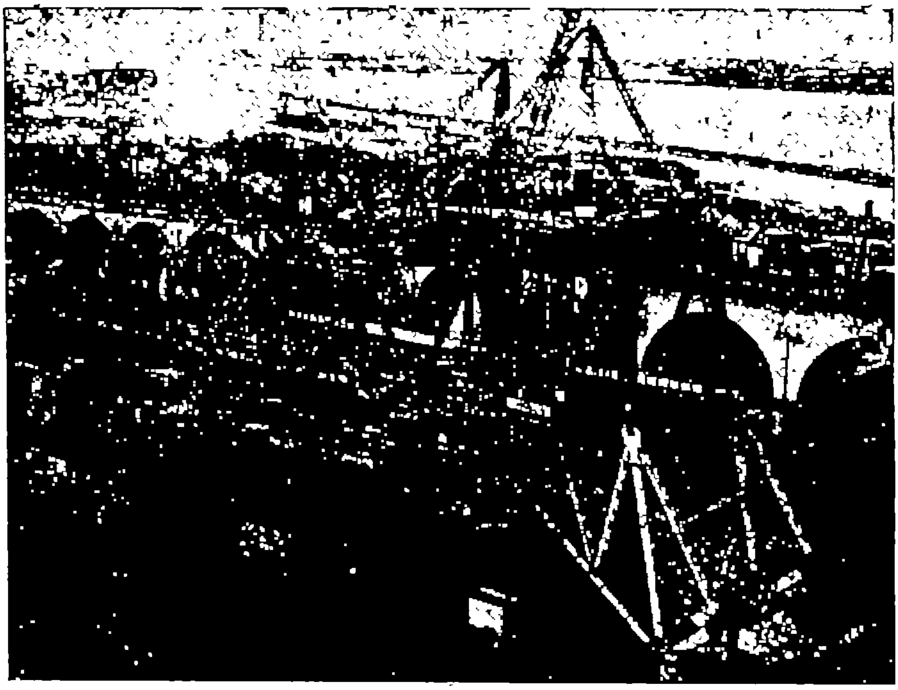
(i) A large concrete skewback pier at about low water mark on the Widnes shore to take the main thrust of the steel arch;

(ii) A similar skewback pier on the Runcorn side sited on the south shore of the Manchester ship canal;

(iii) A side pier on the foreshore on the Widnes side to support the end of the side span;

(iv) An approach pier on the Widnes side at approximately high water mark; and

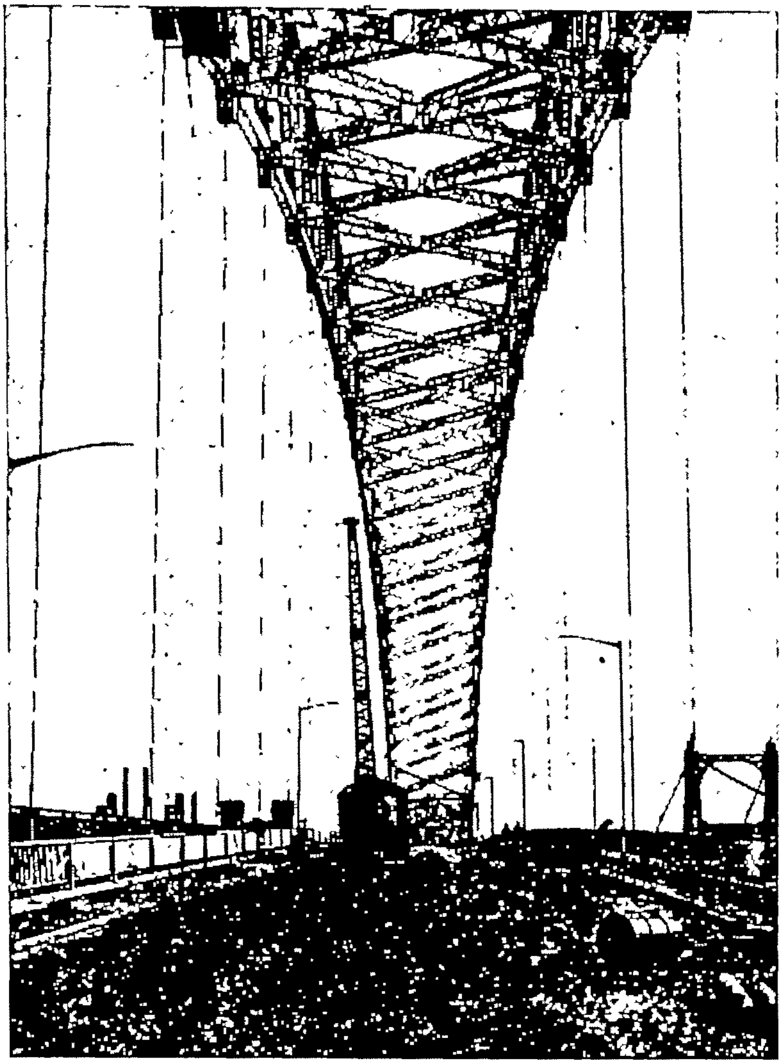
(v) Foundations for the trestle supporting the end of the side span of the bridge in Runcorn.



The Runcorn side span of the Runcorn main bridge is substantially completed but is still supported on temporary military trestling

A difficult problem in carrying out the contract works was the construction of the temporary cofferdam for the Widnes skewback pier. The purpose of the cofferdam was to enable excavation for the foundation in sound rock below river bed level to be carried out. There was considerable delay in construction due to unusually high water levels in the river. All the piers are of reinforced concrete construction. The tender of Dorman Long (Bridge & Engineering) Ltd., was accepted by the Bridge Joint Committee in January 1958 for the construction of the arch bridge and the foundations and superstructure of the approach viaducts. Work on the approaches began in March 1958. The main sub-contractor for the civil engineering work was Leonard Fairclough Ltd.

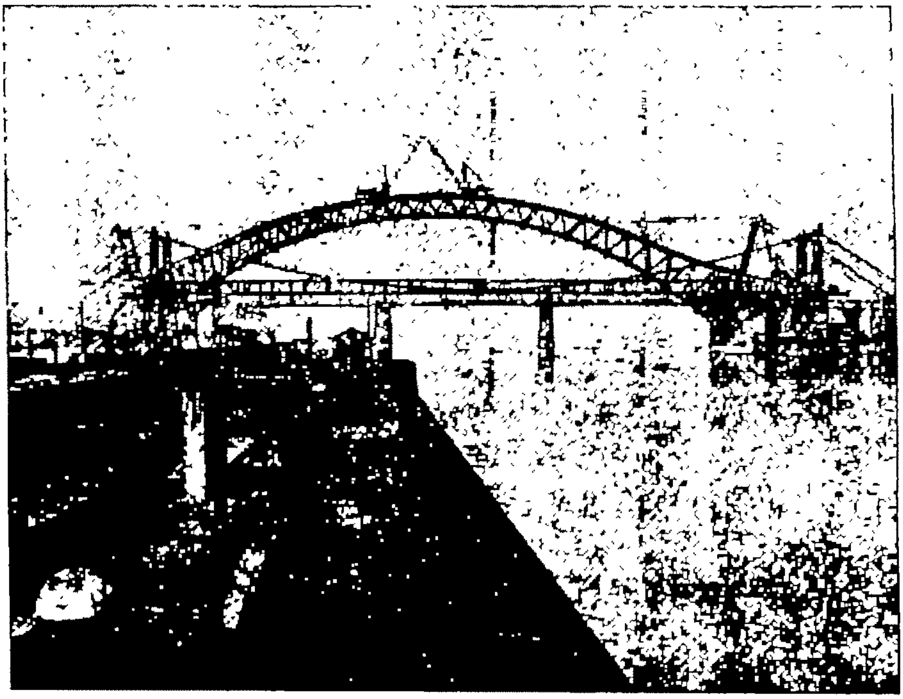
The project was sponsored by the Runcorn-Widnes Bridge Joint Committee and grant aided by the Ministry of Transport. The consulting engineers for the design and supervision of the works were Mott, Hay & Anderson. The total estimated cost, including property acquisition and rehousing, is about £2.9 millions.



A view of the main bridge suspended deck from the Runcorn bottom chord portal

The main bridge is 1,628 ft. long and includes a central arch span of 1,082 ft. between the main bearings with a rise of 252 ft. 6 in. from the bearings to the top chord. At each end of the arch span, there are 250 ft. steel side spans continuous with the arch. The main bridge has two arch trusses 54 ft. apart, their depth varying from 35 ft. to

95 ft. approximately, the trussed chords being generally of 33 in.×27 in. box section. Hangers of locked coil steel wire rope are suspended from the arch ribs to support the deck of the bridge which is constructed of welded steel cross girders and stringers with a reinforced concrete deck surfaced with hand-laid mastic asphalt.



Both Runcorn and Widnes half-arches erected to centre immediately prior to closure

The principal technical data are summarized below :

Main span	.. 1,082 ft.
Two side spans	.. 250 ft. each
Height of arch	.. 282 ft.
Total length of scheme, with reinforced concrete viaduct approaches	.. ¾mile (nearly)
Width of carriageway	.. 33 ft.
Width of two footpaths	.. 6 ft. each
Quantity of steel work	.. 5,900 tons

The only other known longer span arch bridges are the Bayonne bridge of 1,652 ft. span in New York State, U.S.A., and the Sydney Harbour bridge of 1,650 ft. The new bridge, therefore, has the third longest span of its kind in the world, and excluding other bridges at present under construction, it is the longest bridge span of any type of bridge in England, and the longest arch span in Europe.

ADDRESSES OF CHAIRMEN AT THE ANNUAL GENERAL MEETINGS OF THE LOCAL CENTRES

Bengal Centre

Chairman's address by Shri S. Bandopadhyaya, B.Sc.(Eng.), M.I.E., at the 42nd Annual General Meeting of the Centre on December 28, 1962.

After welcoming the Chief Guest, Shri B. Das Gupta, I.A.S. (retired), Chairman, Public Service Commission, West Bengal, and other invitees, Shri Bandopadhyaya, thanked the Committee of the Centre for electing him Chairman for 1962-63.

Delivering the Chairman's address, he said, 'In my address last year I made an attempt to analyze civilization and engineering and tried to trace out their growth and development in the almost connected aspects of parallelism and synonymity. At the cost of repetition, it may be mentioned that it is extremely interesting to observe how civilization and engineering have gradually unfolded themselves in the diverse space-time relations and have interated on and strengthened each other as cause and effect as well as effect and cause, so that finally a deep analysis brings one to the bewildering stage where it is difficult to make a clear distinction between the two. Obviously. engineering is a part of civilization. Yet during the process of development, the part has merged so completely with the whole that the distinct entity has been lost and a complete organic integration has been effected. It is almost analogous to biological growth. Just as the urges and aspirations and needs created by the growth of civilization have brought out the development of various branches of engineering, so the improved and ever improving technology and technocracy of engineering have created the scope for the progressive unfolding of civilization. And the most striking feature of this connection is that though engineering represents the material aspect of human thought and endeavour, in its progressive march, it has left indelible marks in the path of civilization in all its aspects—material, intellectual and moral. Possibly, the word spiritual would be going too far. This brings us back to the central idea of the organic whole and that is my subject today.

Again, in my last address, I brought out two fundamental and basic concepts which have very close relations between themselves. I shall attempt to expand them in order to lay before my brother engineers my idea of the duties and ideas of an engineer. One is the concept that engineering is as much an empiricism as a science. The concept is really very simple to require elaboration. In the creative and formative processes of the various branches of engineering, it is a science. There it has all the attributes and reasoned and reasonable certainties of science and can be delivered in and developed in the thinking laboratories of the human mind. Numerous examples may be given of this scientific aspect of engineering and the role it has played in the progressive development of the practical effects created. As a matter of fact, the tremendous technological advance in the last two centuries clearly reveal the concentrated thinking efforts of highly scientific minds under fairly abstract conditions. At the same time, the practical applicaton of engineering which comes for all uses of mankind is empiricism par excellence. There we see examples of toil in all its ramifications and vicissitudes. Experience and knowledge gathered through trial and error and through experimental work in all its stages of incomplete development have been the guiding factors in this tale of toil where more and better data have been patiently collected from the incompleteness and errors of the past. We all know that the man of yesterday, the man of today and the man of tomorrow are often widely different creatures. So, in catering to the needs and requirements of this constantly changing creature, engineering has to grow continually in its space-time relations and this is why the empirical part of engineering has its importance and special significance. This in short is the analysis of this concept.

Now we come to the other concept, the concept of the homo sapiens developing into the homo faber. Here also, though the distinction remains, there is a distinct merging of the two as well as the tendency of one developing the other in a continuous process. Possibly it is correct to conceive the emergence of the homo sapiens originally and the development of the homo faber through its various needs, hopes and aspirations. But it is equally true that the homo faber through diverse activities, efforts and achievements has been able to develop the homo sapiens of a much more subtle and higher order. This is the impact the homo faber has given on human civilization in pushing it towards its goal of creative and living unity.

This is my thesis and I have believed it all my life—this progressive idealization of ideas and its translation into effective material processes through constant endeavour. The homo faber does the endeavour and represents the empirical end of the table whereas the homo sapien is the originator and thinker representing the scientific end of the table. Yet the two should not only collaborate but constantly synthesize. Then only we can get a picture of the organic whole. If a little mixed analogy be permitted, I would call it the socio-biological counterpart of the mathematical concept of the evolute and the involute. Throughout the various processes in the world of nature and man, I can see this synthetic unity of ideals and ideates, aspirations and efforts, necessities and achievements, one following, chasing, overtaking and again reverting to the other in various shapes and forms, successes and failures, even advances and deteriorations to the ultimate purpose of a continuum of thought and action tracing the progress of the homo sapien and the homo faber in the eternal path of science and empiricism. This brings us to the very material sphere of our Institution and us engineers. It may be questioned why such a forum should bring out such effusions. I have a notion that it is in the fitness of things. In these progressive days, the set occupation of a man creates a specific sphere for him. Those who are engaged in and dedicated to a highly specified and specific type of work automatically create for themselves a specific world of their own with its specific problems and requirements. It cannot be denied that we engineers have created such a world for ourselves and it is our duty as much as it is our necessity to search and analyze not only the problems of humanity that we endeavour to solve and bear the load that such problems give rise to, but it is also very necessary that we analyze the problems that we create for ourselves and constantly endeavour not only to solve but also to transcend in trying to build up a band of dedicated and capable workers in the cause of humanity. In such work, not only has the individual engineer to play his rational, effective and moral part but the Institution which is the physical and intellectual conglomerate of all its individual members should also play the important part of effecting the binding unity in the methodology of work as well as the moral purpose.

This thought brings us today to a matter of great import. This matter is at present confined to a few people and a small part of the world. Yet, fundamentally, it is a matter of great importance to mankind and basically challenges the ideas that I have tried to propound. It is true such crises have occurred again and again in this world, producing temporary setbacks in the path of peaceful progress of civilization, just as in the case of individuals severe ailments cause harm and setback to healthy growth. And the remedy and cure are very much the same. With utmost faith in the ultimate good, one has to stand up and fight and eradicate the disease. I am referring to the unreasonable aggression on India by an enemy country. We engineers need not go into the political antecedents of the case. To us, the fact remains that we face a great peril and a great struggle. In this situation, the engineers shall have to play a very important part. Such a struggle demands combative, protective and curative measures of great magnitude and detail. I call upon my brother engineers to stand beside our countrymen in this hour of peril and struggle to give all of their ability and knowledge. I feel that the need is near and intense. I shall leave out the matter of combative measures to those specially engaged in it. But I feel that very elaborate, extensive and difficult protective and curative measures will have to be undertaken before very long in which engineers will have to fulfil a very important and difficult task. I am referring to civil defence works required as a result of military operations. It is well known that modern aerial warfare puts a heavy burden of trouble and sorrow on the entire civil population. Highly technical protective pre-air raid safety measures have to be undertaken as well as much more immediate and intensive curative measures in the form of clearance, repairs, etc. after an air raid. All this requires the building up of a very efficient and instantly mobilizable technical organization. I have agreed and it is possible that I shall undertake the coordination of this stupendous task and I intend to utilize the services of all my brother engineers in that task. I intend to utilize the Institution fully in all its worth, capability and tradition to help me in that task. It would be necessary to organize the process of working in great detail through a series of meetings and formation of sizeable and workable groups. I intend to do so after due deliberation with my Local Centre Committee as well as all the corporate members of this Institution. I appeal to and demand the services and goodwill of all the members in this task. Ours is a body of great eminence and magnitude, and I am sure that in this hour of national peril and need it will respond to such a need, and by its ability, perseverance and sacrifice throw a beacon light on the path of righteousness and sanity which is the heritage of all humanity.'

Gujarat Centre

Chairman's address by M. M. Patel, B.E., M.I.E., at the Third Annual General Meeting of the Centre on December 16, 1962

After welcoming the Chief Guest, Dr. M. S. Thacker, B.Sc.(Eng.), D.Sc., Member (Education), Planning Commission, Government of India, and other invitees, Shri Patel introduced Dr. Thacker and thanked the Committee of the Centre for electing him Chairman for 1962-63.

Delivering the Chairman's address, he said, 'The Gujarat Centre came into existence almost immediately after the new State of Gujarat was formed and is perhaps the youngest Centre of the Institution. The Centre when formed had 1,075 members, which included 294 Corporate Members. This number increased to 1,200 with 336 Corporate Members in August 1961 and to 1,453 including 447 Corporate Members at the end of the second financial year.

Although this figure is fairly comparable with other new Centres, it cannot be said to be satisfactory in consideration of the fact that the Gujarat State has three universities, five engineering college and eleven polytechnics. This may be perhaps due to lack of interest in the activities of the Institution, as we had no Centre or sub-Centre in Gujarat prior to 1959. With the formation of the Gujarat Centre at Ahmedabad with a Sub-Centre at Baroda, the membership must increase considerably now. The members should help the Local Centre Committee in getting many new members.

The formation of this Centre and the starting of its activities immediately was made possible by the cooperation of the Gujarat Institute of Civil Engineers and Architects, which provided the necessary accommodation for this Centre. I take this opportunity to thank the office bearers and members of that Institute.

To accelerate the activities of the Centre, it will be necessary to have more accommodation. The present building of the Gujarat Institute of Civil Engineers and Architects will have to be extended substantially or the Centre will have to find out a new premises of its own.

The Ahmedabad Municipal Corporaton has provided a plot at concessional lease for the building of the Gujarat Institute of Civil Engineers and Architects. I appeal to the Government to allot likewise a similar plot of about 2,000 sq. yd. for our Centre from the open land opposite to this building.

Elsewhere in this country, the State Governments have helped the Institution not only by providing land free of charge, but have also granted substantial amounts for the construction of a building as well. I appeal to the Council of the Institution to allot the necessary funds for a building of this Centre.

PAINTED TO FIGHT CORROSION

For over a century Red Lead has been used as a priming paint on bridges, ships, wagons and structures and still continues to be the best protection against rust and corrosion.

The Jetty and sea-water pipeline as well as other steel structures of the Atomic Power Plant at Trombay were primed with RED LEAD.

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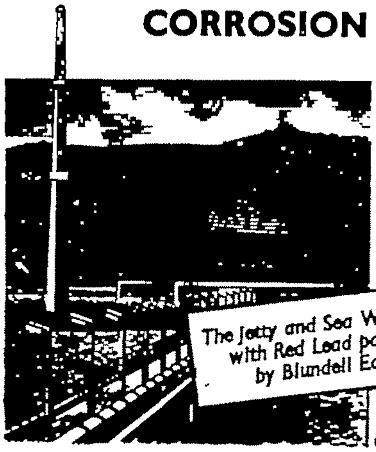

The Jetty and Sea Water pipeline primed with Red Lead paint, manufactured by Blundell Eomite Paints Ltd

D. WALDIE & CO.
(LEAD OXIDES)
LTD.

Gillander House, Netaji Subhas Road, Calcutta-1

Secretaries & Treasurers GILLANDERS ARBUTHNOT & CO. LTD.
Calcutta Bombay Madras New Delhi Kanpur

DWC-6

EMPLOYMENT SERVICE

This service is intended for the benefit of members of the Institution and for the Government, industrial and other organizations employing engineers. It is hoped that the employers will make full use of this service to obtain their requirement.

A small charge of Rs. 5 per insertion will be made to members for notices appearing in the 'Situations Wanted' column.

In the 'Situations Vacant' column a charge of Rs. 2 per line will be made.

Replies to advertisements should be addressed to Employment Service, The Institution of Engineers (India), P. O. Box No. 669, Calcutta 20, except where otherwise stated.

SITUATIONS WANTED

YOUNG ENGINEER, passed Sections A and B of the Associate Membership Examination of the Institution of Engineers (India) with aeronautics as one of the subjects and having two years apprenticeship experience in mechanical side, seeks suitable post in aeronautical side in India or abroad. (Office ref. E.S. 120)

STUDENT of the Institution of Engineers (India), B.Sc., L.E.E., passed diploma course in automobile engineering, age 25, having about six months practical training in the Government transport workshop is available for immediate employment. (Office ref. E.S. 121)

RETIRED GOVERNMENT ADMINISTRATIVE OFFICER, M.I.E., with 30 years experience in all kinds of civil engineering works and workshops, trained in the U. K. and well travelled, can efficiently command any manufacturing firm in engineering or construction works, age 55, excellent health. Reasonable salary will be accepted. Assignments outside India also acceptable. (Office ref. E.S. 122)

CIVIL ENGINEER, B.Sc., B.E., A.M.I.E., having 14 years experience, —6 years in irrigation works in the P.W.D., 4½ years in construction of factory buildings with R.C.C., steel, prestressed concrete structures, 3½ years in teaching in an engineering college, at present working as Head of the Department of Civil Engineering, seeks a suitable employment either in professional field or academic line. (Office ref. E.S. 123)

GRADUATE of the Institution of Engineers (India), aged 27, having 2 years training as apprentice, and 4½ years experience in construction of industrial and multistoreyed R.C.C. buildings for government and private firms, seeks suitable job. Available within a month. (Office ref. E.S. 124)

STUDENTS (*contd.*)

No.	Name
39863	Bhupendra Singh
39864	Vishwanath Singh Sachan
39865	Jashmer Singh
39866	Bhushan Lal Jain
39867	Ram Parkash Vig
39868	Nalini Kant Shukla
39869	Susanta Kumar Khan
39870	Jyoti ndra Prasad Sinha
39871	Uma Shanker Agarwala
39872	Girdhari Lal Lahru
39873	Ayalur Ramabadraiyer Mrithyunjayan
39874	Narendra Prakash Srivastava
39875	Balbir Singh
39876	Dattaram Rawaji Patil
39877	Harish Chandra Mital
39878	Syed Husain Zaidi
39879	Brij Mohan
39880	Raj Kumar Sharma
39881	Raghbir Singh
39882	Krishnarajanagar Siddojirao Balaji Rao
39883	Surabhi Gupta
39884	Coimbatore Krishnaswamy Padmanabhan
39885	Santhebennur Raghavendrarao Sreenivasa Rao
39886	Arvind Laxmishakisankar Bhatt
39887	Om Parkash Bhatia
39888	Kanwal Nain Seth
39889	Shiv Shahai Sharma
39890	Parmjit Singh Chadha
39891	Ashoke Kumar Lahiri
39892	Shiv Kumar Garba
39893	K. N. Vijaya Mohanan Nair
39894	Jagadish Kumar Goel
39895	Kailash Narayan Vyas
39896	Sitaraman Srinivasan
39897	Maharaj Prasad Agarwal
39898	A. P. Mukundan
39899	Brigendra Nath Bhargava
39900	Devinder Singh Nagpaul
39901	Milkha Singh
39902	Kanhaiya Tewari
39903	Devisharan Bhat Sharma
39904	Om Parkash Mendiratta
39905	Charan Dass
39906	Jagtar Singh
39907	Karsham Jathalal Chavda
39908	Major Singh Chhina
39909	Sarjit Singh Ghoman
39910	Davalaraju Madhusudana Kalpa Nageswara Rao
39911	H. R. Ranganath
39912	Solomon Vincent Vinod Kumar
39913	Narain Badlani
39914	Subhashchand Jain
39915	Angappa Chatti Thiruvengadam
39916	Surinder Singh
39917	T. R. Balasubramanian
39918	Nanak Ram
39919	P. P. Srinivasan
39920	N. R. Gopalkrishnan

CORRIGENDUM

TO VOL. 12, NO. 2, OCTOBER 1962

Page 83, Roll No. 5553A, instead of 'T. S. R. Nagarajan', please read 'T. S. Nagarajan'.

STUDENTS (*contd.*)

No.	Name
39771	Satyeswar Roy
39772	Anupam De
39773	Jugal Kishore Anand
39774	Ramesh Lal Mukheja
39775	Shiv Raj Singh Tiagi
39776	Sunil Baran Chakrabarty
39777	Amarendra Ray
39778	Samar Kumar Banerjee
39779	Madhav Balkrishna Deshpande
39780	Ghanshyam Bhan
39781	Mahendra Amritlal Shah
39782	Anil Kumar Paul
39783	Prabhakar Keshav Rahane
39784	Padinjaramadam Aravindakshan
39785	Jagdish Bahadur Talwar
39786	Sushil Kumar
39787	Deo Swarup Bharma
39788	Surender Sindhwani
39789	Ram Sewak Sagar
39790	Ranendu Das Gupta
39791	Krishna Kumar Saxena
39792	Arabinda Kundu
39793	Shiam Nath
39794	Ranjit Numar De
39795	Ramesh Chander Chhabra
39796	Rabindra Mohan Sen
39797	Ram Sewak
39798	Shamkant Narayan Deshpande
39799	Surendra Singh Saluja
39800	Padam Lal Kalra
39801	Kiritibhusan De
39802	Brij Mohan Maithani
39803	Dharam Singh
39804	Hriday Nath Kher
39805	Somnath Iyer
39806	Ramrao Shewaji Mane
39807	Main Mohammad Afzal
39808	Asis Kumar Roy
39809	Sudharanjan Roy
39810	Gautam Mahalanobis
39811	Raghunath Sahai Srivastava
39812	Gour Chandra Mandal
39813	Sukhbir Singh
39814	Bhuwaneshwar Nath Srivastava
39815	Subhas Chandra Paul Roy
39816	Panikkasseri Raman Sidhan
39817	Sankar Kumar Bandyopadhyay
39818	Ranendra Nath Sengupta
39819	Anatha Bandhu Acharya
39820	Kattil Chittranath Radhakrishnan
39821	Kayamkulam Sivaraman
39822	Phatik Lal Das
39823	Himadri Kumar Sadhu
39824	A. Balakrishna Pillai
39825	Sonti Bala Surya Subrahmanyam
39826	Bangalore Ramanna Dwaraki
39827	Sajal Kumar Chakravorty
39828	Sudhir Kumar Ghosh
39829	Bapusaheb Annasaheb Ghali
39830	Santosh Kumar Guha
39831	Pradip Kumar Roy Chowdhury
39832	Ram Anugrah Prasad
39833	Bimal Kumar Lahiri
39834	Krishna Gopal Mukhopadhyay
39835	S. Keshavmurti Melkote
39836	S. V. Raman
39837	V. Subramanian
39838	Tapan Kumar Kayal
39839	Kailash Chandra Vijay
39840	Ravi Prakash Agarwal
39841	Kulbir Chander
39842	Kunwar Baldeo
39843	Yogesh Chandra Pandey
39844	Jaipal Singh
39845	H. S. Dinesha
39846	Surendra Nath
39847	Bal Krishan
39848	Jagat Narain Tripathi
39849	Rajendra Kumar Jain
39850	Shoukat Jamil Siddiqi
39851	Ajai Kumar Agarwal
39852	Krishan Lal Chanana
39853	Mahesh Chandra Gupta
39854	Rabindra Nath Majumder
39855	R. Anantharamasubramanian
39856	Shrimati Shyamali Mukhopadhaya
39857	Arjun Deo
39858	Kishori Lal Kashyap
39859	Mool Chand
39860	Prem Chand
39861	Hiranya Kumar Banerjee
39862	Himalaya Joshi

STUDENTS (*contd.*)

No.	Name
39680	Hari Har Gosh
39681	Prabhakar Raghvendra Mudgal
39682	Madhusudan Yeshavant Kulkarni
39683	Sambhu Nath Saha
39684	Jawahar Lal Khanna
39685	Sudhakar Sanjiv Savkur
39686	Narendra Nath Karmakar
39687	Upendra Nath Kanjilal
39688	Dwarka Nath
39689	Surendra Kumar Sharma
39690	Provash Chandra Dey
39691	Ashok Kumar Krishnamurthy
39692	Sadhoo Prasad
39693	Vir Sain Jain
39694	Prodyot Kumar Ghosal
39695	Vembillil Pauloso George
39696	Mohan Chhaganlal Indoriya
39697	Prabhakar Narayan Kunte
39698	Umakant Jha
39699	Samarjit Roy Choudhury
39700	Krishan Lal Batra
39701	Bhalchandra Laxman Sahasrabudhe
39702	Govind
39703	Prasun Kumar Mitra
39704	Ramesh Chandra Karji
39705	Sachayan Das Gupta
39706	Dilip Kumar Das
39707	Prakash Chandra Pal
39708	Sachinath Chatterjee
39709	Purushottam Chintamani Pande
39710	Prabhas Chandra Mullick
39711	David Francis Immanuel Manoel Vincent Desa
39712	Kailash Chand
39713	Rampal Singh
39714	Himmat Sahai
39715	Surendra Prasad Srivastava
39716	Kesho Datt
39717	Debi Datt Sati
39718	Ramesh Kumar Gupta
39719	Surendra Mohan Mathur
39720	Chandrasekharan
39721	Gordhan Prakash
39722	Barun Kumar Maitra
39723	Subramanyam Krishnan
39724	Bansi Lal Kher
39725	Jaikishin Pritamdas Makhijani
39726	Ramesh Satramdass Lachhiramani
39727	Pranab Kumar Banerjee
39728	Harish Chander
39729	Hare Krishan
39730	Suresh Chand
39731	Vilas Bhagwan Ganpate
39732	Amarnath Chattopadhyay
39733	Protip Kumar Chatterjee
39734	Sushil Kumar Jain
39735	Binoyendro Kumar Singha
39736	Naba Gopal Basak
39737	Anjan Kumar Bandyopadhyay
39738	Jagatjyoti Bhanja
39739	Satya Prakash
39740	Radhey Shyam
39741	Pradip Baran Banerjee
39742	Prakash Chandra Srivastava
39743	Dal Chander Jain
39744	Dilip Kumar Sinha
39745	Om Prakash Gupta
39746	Amar Nath Ghosh
39747	Subhas Chandra Bandopadhyay
39748	Ajit Kumar Chattopadhayaya
39749	Ratanmani Bhar
39750	Raghavendra Malharrao Kulkarni
39751	Om Prakash Bhatnagar
39752	Niranjan Bhattacharya
39753	Amal Kumar Bhattacharyya
39754	Shibsadhan Bandyopadhyay
39755	Nimai Chand Nandi
39756	Rupendra Nath Datta
39757	Manik Rao Mandiye
39758	Vishnu Bhagwan
39759	Bipin Kant Gupta
39760	Ram Prakash
39761	Sudarshan Dutt Mehta
39762	Budhi Singh Gusain
39763	Dilip Kumar Ghosh
39764	Girdhari Lal Tiku
39765	Narayana Madhu Sodhan
39766	Asish Chandra Nandi
39767	Dilip Kumar Biswas
39768	Madhav Mukherjee
39769	Udayan Sankar Phani
39770	Shrikant Anant Ganu

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No.	Name
39588	Sukhamoy Basu
39589	Ardhendu Sekhar Ray
39590	Ripudaman Singh Madan
39591	Arun Chandra Bagga
39592	Kamalmoni Mukherjee
39593	Ramesh Kumar Ahuja
39594	Manoj Kumar Laskar
39595	Debabrata Sinha
39596	Nanigopal De
39597	Gopal Das Agrawalla
39598	Pradip Chandra Sen
39599	Pradosh Kumar Sarkar
39600	Rameshchandra Mitra
39601	Sohan Singh
39602	Lakshmibrata Sarkar
39603	Samir Kumar Bandyopadhayay
39604	Shanker Narayan Saha
39605	Yugal Kishore Singh
39606	Gouri Sankar Das
39607	Subhas Chandra Dey
39608	Suresh Chand Jain
39609	Kabindra Lal Roy
39610	Digambar Jijaji Ugaonkar
39611	Prafulla Kumar Mudi
39612	Ram Narayan
39613	Mrinal Kanti Chowdhuri
39614	Pranabananda Sengupta
39615	Matilal Chawdhury
39616	Anil Raye
39617	Chiraranjan Ray Chaudhuri
39618	Adhir Kumar Mitra
39619	Samaresh Ganguly
39620	Manindra Kumar Bhadra
39621	Sudhendra Hanamantrao Desai
39622	Mohan Tarachandaney
39623	Amaresh Naresh Ghatak
39624	Jagdish Chander Bhusri
39625	Ajoy Kumar Chatterji
39626	Samir Kumar Chakrabarti
39627	Nimai Charan Basu
39628	Dipangsu Mohan Bose
39629	Debdas Mukherjee
39630	Sudha Madhab Nath
39631	Niranjan Datta
39632	Prem Bihari Lal Gaur
39633	Nirmal Chandra Kundu
39634	Joydeb Sur
39635	Ranjit Singh
39636	Kashinath Chakraborty
39637	Surrinder Pal Ahluwalia
39638	Chandra Bhushan Mishra
39639	Revansiddappa Fakkirappa Kalledevar
39640	Dinendra Narayan Roy
39641	Jawahir Lal Chrungoo
39642	Siddhi Bhuson Sen Gupta
39643	Hrishikesh Tapadar
39644	Sukhamoy Sarkar
39645	Shrinivas Ganesh Bagul
39646	Mahesh Chandra Garg
39647	Kalambadan Paily Gheevarghese
39648	Kul Bhushan Mody
39649	Lal Naraindas Malani
39650	Suniti Kumar Mukhopadhyay
39651	Gokul Chandra Ghosh
39652	Suresh Sundarrao Kamat
39653	Om Prakash Sharma
39654	Chiranjiv Lal Taneja
39655	Tilak Raj Sharma
39656	C. Venkateswaran Ramachandran
39657	Kartar Bashomal Budhrani
39658	Sohan Lal
39659	Ram Ranglani
39660	Malay Krishna Biswas
39661	Gopal Krishan Verma
39662	Manik Lal Datta
39663	Raziul Hasan
39664	Ram Sharan Saini
39665	Bhalchandra Dhondabarao Salvi
39666	Uday Nath Kaul
39667	Probir Kumar Mukherjee
39668	Priyabrata Mandal
39669	Dilip Kumar Ghosh
39670	Rajandra Prasad Gupta
39671	Rajendra Prakash Garg
39672	Pandurang Bindurao Kodagali
39673	Purushottam Saxena
39674	Subodh Kumar
39675	Mahendra Pratap Sharma
39676	Rajinder Kumar Sachar
39677	Hari Singh
39678	Tej Narain Singh
39679	Alok Kumar Bhattacherjee

STUDENTS (contd.

No.	Name	No.	Name
39496	Vellore Dhanaraman Somasundaram	39542	Samarjit Kumar Roy Chowdhury
39497	E. Janakiraman	39543	Bibhas Chandra Pal
39498	Sundaram Muthuswamy	39544	Susil Kumar Sarkar
39499	Subramanian Venkatesan	39545	Debiprasad Pal
39500	Chingleput Avala Raman	39546	Ashish Kumar Gupta
39501	Palamer Neri-Subramaniam Krishnan	39547	Tushar Kanta Bhattacharyya
39502	Sethu Ramalingam Balakrishnan	39548	Gurudas Banerjee
39503	Akhil Nath Bhattacharya	39549	Gopal Chandra Basak
39504	Vasantrao Shriniwasrao Pandhari	39550	Chandra Sekhar Paul
39505	Vijaybhai Punamchand Pandya	39551	Prasanto Kumar Sinha
39506	Hira Lal Handoo	39552	Sunil Kumar Roy
39507	Asit Kumar Nandi	39553	Nirapada Biswas
39508	Rambir Singh	39554	Arup Kumar Bhattacharyya
39509	Ravindra Krishnarao Chonkar	39555	Arun Kumar Basu
39510	Asim Kumr Mitra	39556	Panna Lal Datta
39511	Ranjan Kanti Chakrabarti	39557	Innenje Hayavadana Rao
39512	Sanat Kumar Sen	39558	Kali Prasad Mukherjee
39513	Bhaskar Mitra	39559	Kasinath Naskar
39514	Arun Kumar Bhattacharya	39560	Ram Nawal Pandey
39515	Susil Kumar Bhattacharyya	39561	Amiya Kumar Shreemany
39516	Shashanka Sekhar Paul	39562	Arun Kumar Sen
39517	Mrinal Kanti Chowdhury	39563	Lakh Raj Das
39518	Tarun Kumar Banerjee	39564	Vedanthasrinivasa Padmanabhan
39519	Ramesh Yashwant Kale	39565	Sukumar Banerjee
39520	Girdhari Jethanand Parwani	39566	Himansu Kumar Haldar
39521	Kundan Lal Anand	39567	Mrinal Kanti Guha
39522	Gaulbert Whittle	39568	Adhir Kumar Nandy
39523	Subir Chandra Sen	39569	Anukul Chandra Das
39524	Gurdip Singh Mehta	39570	Madhabananda Bari
39525	Vijay Bhushan Arora	39571	Pradip Kumar Ganguly
39526	Praveen Mehra	39572	Pradip Kumar Nandi
39527	Nirmal Chandra Banerjee	39573	Syamal Kanti Biswas
39528	Hridey Nath Ganjoo	39574	Dilip Kumar Ghosh
39529	Dilip Kumar De	39575	Mapramathukaran Devassy Joe
39530	Bijay Gopal Garai	39576	R. Venkat Raman
39531	Ashoke Kumar Ghosh	39577	Parimal Kumar Ghosh
39532	Arun Kumar Ghosh	39578	K. Ramalingam
39533	Pranab Sen	39579	Nihar Ranjan Roy
39534	Aloke Coomar Neogy	39580	Hira Lal
39535	Bimal Kumar Mukhopadhyay	39581	Govind Parsharam Ingale
39536	Amitava Bhattacharyya	39582	Anil Kumar Ghose
39537	Asok Kumar Pal	39583	Shyamal Kumar Chakraborty
39538	Arabinda Mudi	39584	Tapasranjan Raychaudhuri
39539	Narendranath Chakrabarti	39585	Santhipada Mondal
39540	Dipak Kumar Sarkar	39586	Pulak Lal Kundu
39541	Harisankar Ray	39587	Ajit Kumar Banerjee

STUDENTS (*contd.*)

No.	Name	No.	Name
39404	P. Mallappa	39450	Daya Shankar Dubey
39405	Manjit Singh	39451	Vasant Gundo Wadappi
39406	Brijlal Beharilal Nihalani	39452	Kersi Jehangirji Choksey
39407	M. G. Ramamurthy	39453	Y. J. Padma Prabhaiah
39408	A. S. Natarajan	39454	N. Manujayya Shetty
39409	Holur Sundararajiyengar Venkatesha	39455	K. P. Isaac
39410	N. Somanath	39456	Subramanian Ramachandran
39411	P. John Jacob	39457	Venkataraman Balasubramanian
39412	Chittoor Mohammed Anwaruddin	39458	Neelamkavil Devassy Francis
39413	Muthuswamy Krishnamurthy	39459	Narayanan Chandrapalan
39414	Shivaramaiah	39460	Balasa Vasudevan Madan Mohan
39415	Rakkanath Kochunny Panickar	39461	M. Srinivasan
39416	Daniel Jacob	39462	S. Upendran Nair
39417	G. S. Lakshminarayana	39463	Shantilal Tribhuvandas Gajjar
39418	Asok Kumar Mitra	39464	Atul Madhukar Deshmukh
39419	S. Prasanna	39465	Moreshwar Narhar Borkar
39420	Shamanna Shankaranarayana	39466	Krishnakant Ishwarlal Jariwala
39421	Jagannathan Chakravarthy	39467	Arun Ramchandra Kulkarni
39422	N. Umesha Rao	39468	P. Bhaskaran
39423	T. Subramoni	39469	Barindra Kumar Chakravorty
39424	Vijaykumar Vishwanath Manekar	39470	R. Gopinathan Pillai
39425	Hebbale Kashipathaiah Ramamurthy	39471	K. Parameswaran Nair
39426	J. Venkataramana Ramamurthy Bhatta	39472	Rama Varma Kochappan
39427	K. P. Rappai	39473	Shaikh Noor
39428	T. Sivaramakrishnan Srinivasan	39474	Raibhan Sakhram Chavande
39429	Kota Prabhakar Rao	39475	Pandurang Narayanrao Guntakal
39430	Magge Srinivasachaiah Venkataseshaiah	39476	Varadarajiyengar Raghunathan
39431	Padmakar Madhav Tare	39477	Ulhas Vasantrao Telang
39432	R. Raja Reddy	39478	P. Krishna Bhatta
39433	M. Siva Raman	39479	N. P. Raman
39434	Athalattu Samuel John	39480	Sharad Ganesh Orpe
39435	M. S. Kumar	39481	Mrinal Kanti Roy
39436	S. Subbiah	39482	Mehnga Ram Shinhmar
39437	George Victor Emmanuel	39483	Bhawandas Lachhiramani
39438	Tirumillai Subramanian Krishnamurthy	39484	Surjit Singh Sohi
39439	Ismail Mohomedally	39485	B. G. Sathyanarayana
39440	Pushkar Mohan Ghosh	39486	E. G. Subbaraju
39441	Shyamsunder Ramachandra Rewankar	39487	R. M. Mruthyunjaya
39442	Perumalpillai Narayana Pillai	39488	V. Selvarajan
39443	Gangam Mahanthayya	39489	Chandi Charan Bhowmik
39444	Ramanathan Venugopal	39490	Dinka Raghunath Row Parkhie
39445	Suresh Ramachandra Phatak	39491	Surinder Kumar Ansal
39446	N. Narayanasastry Satyanarayana	39492	Kewal Krishan
39447	Kiritsinh Sajjansinh Jadeja	39493	K. G. Gopalakrishnan Nair
39448	Moolkey Panduranga Kamath	39494	Devendra Kumar Gera
39449	Susham Kumar Sood	39495	S. Srinivasaraghavan

STUDENTS (contd.)

No.	Name
39312	Ranjit Kumar Chakraberti
39313	Ramani Bhushan Bal
39314	K. C. Virupakshaiah
39315	P. Easwaraiyer Sankaranarayanan
39316	Annayyappa Basappa
39317	Gopal Hari Benerjee
39318	Mohammed Majib
39319	Sachindra Nath
39320	Palli Shekar Shetty
39321	Manohar Govindram Lala
39322	Kadaba Aswathanarayana
39323	R. Narasimhamurthy Dhruva Kumar
39324	Mysore Nanjundiah Shivananjiah
39325	B. Ramasubbiahsetty Krishna Setty
39326	Bettadapura Hiriannaiah Subba Raya
39327	B. N. Marigowda
39328	M. Aswathanarayanarao Ananthakrishna
39329	Nabadwip Kundu
39330	Avinash Chander Ahuja
39331	Podury Venkata Sitarama Anjaneyulu
39332	Joseph Victor Abraham D. Mello
39333	Huchappa Papaiah
39334	Washudeo Sambaheo Mate
39335	Vaidyanathan Rameswamy
39336	Shyamlal Jethananda Kanal
39337	Harshadrai Girdharlal Mehta
39338	Dev Raj Khurana
39339	Ravindra Krishna Sinha
39340	Asadulla Shariff
39341	Prasun Kanti Mazumdar
39342	Boman Jehangir Irani
39343	Shridhar Hari Chandorkar
39344	Nandakumar Madangopal Shingi
39345	Har Prasad
39346	Nonnali Nandyappa
39347	Satya Ranjan Nag
39348	Suresh Chand Sharma
39349	Bishram Sinha
39350	Prabhayya Shankrayya Viraktamath
39351	G. Ramachandra Vittal Prabhu
39352	YashwantVishnu Risbood
39353	Gurunath Dhondu Veling
39354	Hosamane Venkatappa Suryanarayanappa
39355	B. Sankaran
39356	D. Aswathanarayanarao Ranganatha
39357	Srinivasan Rameswamy
39358	Pandurang Shrinivasrao Tankasli
39359	Anand Baburao Keshavi
39360	Balkrishna Vishnu Kamat
39361	M. Prabhakaran
39362	C. Krishna Moorthy Iyer
39363	Suhas Yeshvant Brave
39364	Ashok Nath Chowdhury
39365	Akhileshwar Prasad Gupta
39366	E. Neelakandhan Sivan
39367	Gooty Gundachar
39368	B. S. Manje Gowda
39369	G. A. Venkatappa
39370	K. Vittaldas Joishy
39371	M. Hasan Imam
39372	Umakant Rajeshwar Yavantikar
39373	V. Satya Bodha Rao
39374	N. K. Shanmughasundaram
39375	Gopalakrishna Hari Naik
39376	R. Anantha Narayana
39377	Bimal Kumar Rudra
39378	A. Mahmood Syed Abdul Mateen
39379	Veerappa Mallikarjunappa Maraga
39380	Malur Seshadry Krishnamurthy
39381	Abdul Aziz
39382	Anandampilli Ananthachar
39383	Krishnaswamy Balasubramanyam
39384	M. G. Vedavyasachar
39385	Dinesh Chandra Thapliyal
39386	Vinod Prakash Mathur
39387	Ganpati Manjunath Kanchugar
39388	Sreenivasaiah
39389	Nazir Ahmed M. Miskin Khan
39390	Kattil Chittedath Unnikrishnan
39391	V Venkatarangaiah
39392	Mohammed Ziaur Rahman
39393	Peddahanumanna
39394	Virupapura Channagasastry Parameshivaia
39395	B. S. Kodandaram
39396	Hassan Puttasiddaiah Chandrasekara
39397	Melarkode Sankaraiyer Ananthanarayanan
39398	Mathuradas Hirji Thacker
39399	Sadanand Anant Datar
39400	Eddya Vasudeva
39401	P. Siddaiah
39402	Bhimarao Nanjundaiah Gundu Rao
39403	G. B. Renukappa

STUDENTS (*contd.*)

No.	Name
39221	Sunil Kumar Haldar
39222	Arun Kumar Basu
39223	Arun Kumar Bose
39224	Pijush Kumar Bandyopadhyay
39225	Niranjan Kumar Ray
39226	Pradip Kumar Datta
39227	Alok Kumar Sen Gupta
39228	Bhagwati Prasad
39229	Ravi Kant Malhotra
39230	Raj Bahadur Gupta
39231	Vinod Kumar Vig
39232	Amba Prasad
39233	Thalahally Ramachandrarao Krishna Murthy
39234	Harpal Singh Sharma
39235	Triloki Nath Sharma
39236	Brij Bhushan Sawhney
39237	Om Prakash Dua
39238	Hansraj Taneja
39239	Indrasan Singh
39240	Sushil Kumar Chakraborty
39241	Virendra Kumar Sethi
39242	Kunwar Naunehal Singh
39243	Ram Murti Kohli
39244	Samir Lal Mukhopadhyay
39245	Padam Singh Tomar
39246	Saryu Raut
39247	Narendra Kumar Sinha
39248	Tumkur Puttasiddappa Vinod
39249	K. V. Lakshminarayana Setty
39250	Koolavoor Seetha Ram
39251	G. D. Louis Vijaya Kumar
39252	Ved Prakash Talwar
39253	Krishnarao Nagaraja
39254	Hira Lal Garg
39255	N. Narasimhaswamy
39256	Upendra Singh Tomar
39257	A. N. Chandrasekharasastry
39258	Kailash Chand Gupta
39259	Kamta Prasad Singh
39260	Krishna Mohan Tewari
39261	Dibyendu Kumar Mitra
39262	D. K. Bhanuprakash Jamadagni
39263	Arbind Kumar Thakur
39264	Mahesh Prasad
39265	Supriya Rana
39266	T. K. Sukumaran
39267	Ajit Kumar Khan
39268	Ramanathan Venkataraman
39269	V. Janardhanarao Raghavendra
39270	Satnur Narayanarao Ramachandra Rao
39271	Ratnam Vijaya Raghavan
39272	Sibasish Sen
39273	Gupteshwar Dubey
39274	Krishna Chandra Panda
39275	Dummi Veerappa Chandramouli
39276	Sourindra Mohan Chatterjee
39277	Dilip Kumar Bandyopadhyay
39278	Syed Khaleel Ahmed Khureshi
39279	Malhar Sadashiv Joshi
39280	M. V. Kuriako
39281	Vijaykumar Ramchandra Puntambekar
39282	Basith Abdul Gaffor
39283	Abdul Hameed Khan
39284	Venkatanaranappa Gundu Rao
39285	M. S. Kuppaswamy Iyengar
39286	T. B. Padmaprabha
39287	B. S. Rangappa
39288	Embar Seshadri
39289	R. K. Venkatarangaiah
39290	B. N. Keshava Murthy
39291	E. P. Cowshik
39292	V. S. Narayana Murthy
39293	T. N. Seetarama
39294	H. S. Shambhulingaiah
39295	K. V. Sreenivasa Murthy
39296	Honnenahalli Shamarao Nanjundaswamy
39297	Kodanda Rama Setty
39298	Sundara Rajaiyengar
39299	Raghavendrarao Narasinga Rao
39300	Anantharamaiyer Meenakshi Sundaram
39301	Sultanpillai Kasim Pillai
39302	H. K. Shamanna
39303	K. S. Ananthasubbarao
39304	Sindhughatta Krishnamurthy
39305	Lakshminarayan Rama Swamy
39306	Puttaramasetty Mahadeva Setty
39307	K. Chandrashekara Bhat
39308	Pandellapalli Sri Rama Mangaiah
39309	Guthur Puttaveerappa
39310	Devi Prasad Gupta
39311	Ram Janma Ram

STUDENTS (*contd.*)

No.	Name
39129	Satyendra Nandan Sahay
39130	Jageshwar Prasad
39131	Sushil Kumar Mukherji
39132	Ramji Lal
39133	V. N. Krishna Kumar
39134	Subhash Kanta Mukherjee
39135	Ardhendu Seekhar Niyogi
39136	Vishnu Dutt Didwania
39137	P. K. Balakumar
39138	Mohan Petu Naik
39139	G. J. Ramalingam
39140	G. V. Venkata Satyanarayana Murthy
39141	Mohinder Singh
39142	Surendra Kumar Rastogi
39143	Anirudha Roy
39144	Jyotirmoy Banerjee
39145	Arun Kumar Das
39146	Prasanta Kumar Bandyopadhyay
39147	Dayanand Mandal
39148	Ratnesh Mukherjee
39149	Naresh Chander
39150	Monomohan Mukherjee
39151	Bholanath Samajdar
39152	Kanai Lal Chatterjee
39153	Ranjan Kumar Ray Chaudhuri
39154	Ketakiranjan Bhattacharyya
39155	Sunil Kumar Bit
39156	Arnab Kumar Chaudhuri
39157	B. Anantharam
39158	Biman Behari Mohanto
39159	Prasanta Kumar Nag
39160	Shyam Nandan Prasad
39161	Sukumar Mittra
39162	Ajit Kumar Chakravorty
39163	Nirmalendu Sekhor Lahiri
39164	Biswanath Mondal
39165	Bhabani Charan Ghosh
39166	Surinder Kumar Bhatia
39167	Harchand Singh Kaler
39168	Syamal Kumar Mukherjee
39169	Samarendra Chandra Paul
39170	Tarun Kumar Basu
39171	Annadaprasad Maji
39172	Dilip Kumar Jana
39173	Debesh Kumar Banerjee
39174	Srikishna Bhattacharyya
39175	Shanti Prosad Chatterjee
39176	Pranab Majumdar
39177	Dipak Sarkar
39178	Subramanyam Nagarajan
39179	Madan Mohan Roy
39180	Yogendra Deo Singh
39181	Bharat Puran
39182	Anil Behari Patwari
39183	Syed Mustafa Ali
39184	Ajay Narayan Singh
39185	Sudhanshu Bhusan Choudhury
39186	Jiwan Hundoo
39187	Mulo Basarmal Manglani
39188	Gulab Chand Verma
39189	Mahaveer Kumar Jain
39190	Sunder Singh
39191	Govind Prasad Arora
39192	Kishanlall Mathur
39193	Hanwant Singh Lunker
39194	Mool Raj
39195	Gopi Shyam Sharma
39196	Bhanwar Lal Dhabhai
39197	Gurmukh Singh Bir
39198	Vijaya Kumar Uppal
39199	Chand Narain
39200	Prem Shanker Trivedi
39201	Bishan Swarup Gupta
39202	Ramesh Kumar Wahi
39203	Bhagat Ram
39204	Parimal Kumar Mandal
39205	Dilip Kumar Gangopadhyay
39206	Partha Sarathi Datta
39207	Devabrata Sikdar
39208	Padaranjan Sinha Majumder
39209	Sujit Kumar Acharyya
39210	Subhendu Biswas
39211	Mrinal Kanti Paul
39212	Dulal Chandra Chakraborty
39213	Dilip Ranjan Das Gupta
39214	Harjit Singh Chopra
39215	Kailash Chander Malhotra
39216	Jawahar Lal Khanna
39217	Sujitpada Chakrabarti
39218	Sugata Sarkar
39219	Gauri Shanker Singh
39220	Mrinal Kanti Chattopadhyay

STUDENTS (*contd.*)

No.	Name
39037	Harbans Singh
39038	Ram Chandra Jha
39039	Lakshman Prasad Sinha
39040	Jagjit Satnam Singh Sagoo
39041	Nitai Chanda
39042	Bhagwat Singh Tilara
39043	Arawind Narayan Ingale
39044	Hasmukh Nagindas Mehta
39045	Shanti Swaroop Lal
39046	Niranjan Prabhashanker Mehta
39047	Jagan Nath
39048	Rajwant Singh
39049	Ram Janma Singh
39050	Sukomal Chandra Dutta
39051	Chaman Lal
39052	Surindr Kumar
39053	Anilkumar Chunilal Joshi
39054	Vishnu Sahay
39055	Ramagya Upadhyay
39056	Sundar Lall
39057	Atma Singh Sekhon
39058	Pranab Kumar Adak
39059	Om Parkash Bhatia
39060	Rajinder Kumar Baweja
39061	Hormaz Shavaksha Chhindiawala
39062	Ishwar Chand Chutani
39063	Darshan Singh
39064	Vishwa Mittar Bhandoh
39065	Harbans Singh Gill
39066	Ramanlal Jethalal Patel
39067	Dharam Vir Handa
39068	Raghbir Singh Virdi
39069	Jagmohan Lal Maingi
39070	Ujagar Singh Virk
39071	Kailash Nath Julka
39072	Rajinder Singh
39073	Surinder Kumar Singla
39074	Avnash Chander
39075	Niranjan Singh Gill
39076	Bhag Chand Rattu
39077	Avtar Singh
39078	Rajinder Singh
39079	Surinder Kumar Bahri
39080	Rajendra Prasad Sah
39081	Rameshchandra Ambalal Soni
39082	Raj Kumar Kambo
39083	Buddhadeo Baitha
39084	Nand Lal Batra
39085	Satdev Singh Paul
39086	Krishan Kumar Gupta
39087	Pyara Lal
39088	Nand Gopal Sardana
39089	Gundo Govindrao Kulkarni
39090	Mahinder Parkash Malhotra
39091	Kirit Navnitlal Sanjanwala
39092	Shri Niwas Suman
39093	Jagat Mohan Prasad
39094	Pradip Kumar Ganguly
39095	Surendra Kumar Girdhar
39096	Krishna Shanker Mathur
39097	Dinesh Bahadur Sinha
39098	Jagdish Prasad Gupta
39099	Yugal Kishore Srivastava
39100	Pradyut Kumar Paul
39101	Parimal Kumar Chowdhury
39102	Narendra Singh Likhari
39103	Kamatchi Balusamy Baskaran
39104	Chandra Shekhar Kumar Gupta
39105	Brij Bhushan Das Agarwal
39106	Bibhuti Bhusan Das
39107	Kuldip Chand Bhardwaj
39108	Laxmi Chand Pachar
39109	Thundiyil Kakkadavath Ramachandran
39110	Dewat Ram Jakhal
39111	Gur Baksh Singh Sodhi
39112	Kailash Prasad
39113	Dineshwar Prasad Sinha
39114	Parmeswar Dewal Yadava
39115	Chintaman Sitaram Dande
39116	Hari Dayal Singh
39117	Abdul Majeed
39118	Mangala Prasad Singh
39119	Manda Rama Narayana Rao
39120	Sudhanshu Sekhar Mohanty
39121	Satya Ranjan Sinha
39122	Kishori Lal Ram
39123	Ram Sakal Prasad
39124	Nityananda Chaudhury
39125	Gurmukhsingh Kewalsingh Ahuja
39126	Prem Nath Kapoor
39127	Jagdish Pandeya
39128	Om Parkash Arora

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No.	Name
38945	Bhola Singh
38946	Bhudeo Gope
38947	Sujit Singh Gill
38948	Samir Kumar Chatterjee
38949	Ramanbhai Chhotabhai Patel
38950	Iqbal Singh
38951	Rajinder Singh
38952	Avtar Krishan Anand
38953	Brat Pal Bhardwaj
38954	Om Prakash Verma
38955	Parmanand
38956	Lakharaju Venkateswara Rao
38957	Prithvi Raj
38958	Kali Parshad Jairath
38959	Hari Shankar Sharma
38960	Rabindra Nath Mishra
38961	Tek Bahadar Singh Sindhu
38962	Hardev Singh Deve
38963	Joginder Singh
38964	Karuna Shanker Awasthi
38965	Hans Raj
38966	Kanwal Darshanlal
38967	Ved Prakash Suri
38968	Ramesh Chander
38969	Mohan Lal Singal
38970	Tarsem Lal
38971	Om Parkash Kubba
38972	Ranchhodbhai Shankarbhai Mochi
38973	Om Prakash
38974	Darshan Singh
38975	Surindar Mohan Singh
38976	Umakant Dahyabhai Shah
38977	Tilak Raj Dhingra
38978	Hari Kishore Jha
38979	Jonnalagadda Satyanarayana Murty
38980	Krishan Sarup
38981	Ahish Kumar Kar
38982	Harbans Singh
38983	Ramesh Chander
38984	Santokh Singh Saini
38985	Balbir Singh
38986	Nanak Singh Matharoo
38987	Agia Singh
38988	Nikhil Kumar Sanyal
38989	Tahaumur Hossain
38990	Jayantilal P. Bhagdev

No.	Name
38991	Subhas Chander Malhotra
38992	Gian Chand Verma
38993	Subhash Jayantilal Mehta
38994	Bishan Dass
38995	Devinder Singh Walia
38996	Bhola Nath Bhatia
38997	Chaturvedula Subramanyam
38998	Jagdish Mitter Gupta
38999	Manohar Lal
39000	Surinder Kumar
39001	Shah Mohammad
39002	Sohan Lal Chhabra
39003	Harbhajan Singh Galeh
39004	Mahesh Chandra Gupta
39005	Kuldip Raj Mahajan
39006	Parminder Paul Singh
39007	Kantilal Jethalal Parikh
39008	Dipak Kumar Roy
39009	Charanjit Singh
39010	Rajinder Singh
39011	Pradiman Krishan Raina
39012	Harmit Singh
39013	Rajendra Prasad Singh
39014	Rattan Chand
39015	Kanti Prasad Aggarwal
39016	Baldev Singh Sambhi
39017	Mahesh Chander Wadhwa
39018	Awtar Singh
39019	Harish Chander
39020	Amiya Moy Palit
39021	Baljit Singh Walia
39022	Jagdish Rai Goel
39023	Ramesh Kumar Srivastava
39024	Krishan Chand
39025	Krishan Kumar
39026	Bal Krishan
39027	Ram Prit Sharma
39028	Avtar Singh
39029	Sudhakar Ganesh Bhole
39030	Bishambar Dass
39031	Lachhman Singh
39032	Jagdish Chander Gandhi
39033	Ashok Kumar Nayar
39034	Rathindra Nath Bagchi
39035	Krishan Murari Sharma
39036	Hardev Singh

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No.	Name
38853	Bishwanath
38854	Madan Lal Wadhwa
38855	Jagadish Prasad Munka
38856	Darshan Singh
38857	Ajit Singh Birdi
38858	Charanjit Singh
38859	Baleshwar Prasad Singh
38860	Jaimangal Roy
38861	Mahabir Poddar
38862	Bhagwanji Manjibhai Patel
38863	Nilkanth Anant Sathe
38864	Francis Xavier Pereira
38865	Dattatraya Ramachandra Kolhatkar
38866	Ravindarnath Harlal Kohli
38867	Ram Lal Misra
38868	Hardev Singh
38869	Kuldip Singh
38870	Sukhdev Singh Ahluwalia
38871	Gautam Yeshwantrai Pathak
38872	Manharlal Ravishanker Dixit
38873	Paritosh Chakravorty
38874	Ajoy Kumar Lall
38875	Ravindra Nath Chaudhary
38876	Sukhendu Kumar Ghose
38877	Lalit Kumar Waleecha
38878	Kranti Kumar Rishi
38879	Mangatram Goel
38880	Sunil Kumar Ray
38881	Jai Bhagwan Goel
38882	Jagir Singh Dhillon
38883	Nirmal Kumar Chatterjee
38884	Ramesh Chander Kalra
38885	Umrao Singh Sidhu
38886	Shiva Chandra Narain Sinha
38887	Tapan Kumar Bhattacharya
38888	Subhash Chander
38889	Subhas Kukhopadhayay
38890	Balbir Singh Sodhi
38891	Naresh Chander Tuli
38892	Mohinder Paul
38893	Prem Gopal
38894	Bachittar Singh Dhaliwal
38895	Prem Singh Dhiman
38896	Sultan Singh Redu
38897	Jarnail Singh
38898	Ramchandra Ganpatram Patel
38899	Jasbir Singh
38900	Gopal Balkrishna Kulkarni
38901	Ram Dia Vashista
38902	Gopal Krishan Pangasa
38903	Bhupinder Singh Ubbi
38904	Bhim Sen
38905	Ramesh Chandra Dahyabhai Patel
38906	Sarbjit Singh Achreja
38907	Inder Kumar Sukhija
38908	Vipinchandra Ambalal Patel
38909	Ramsinghasan Prasad
38910	Mihir Kumar De
38911	Ram Sagar Sharma
38912	Tej Prakash Sharma
38913	Ramanbhai Hargovindbhai Patel
38914	Amrutlal Thakordas Limbachia
38915	Jag Vasaya
38916	Dharamshi Jivaraj Pipaliya
38917	Santokh Singh Arshi
38918	Ramji Dass Sehgal
38919	Surya Narayan Thakur
38920	Mozammel Haque
38921	Alakh Niranjan Prasad Singh
38922	Yadubansh Singh
38923	Surendra Prasad Singh
38924	Hriday Narayan Gope
38925	Barid Baran Singha
38926	Shashi Ranjan Prasad
38927	Meghraj Singh
38928	Jatinder Krishna Kaplash
38929	Surinder Singh Ganshi
38930	Bharat Singh Sindhu
38931	Santhanamuthu John Mariadoss
38932	Uttam Prasad
38933	Prithvi Raj
38934	Arjun Lal
38935	Malkit Singh Khaira
38936	Shiv Kumar
38937	Phool Chand Garg
38938	Rajendra Prasad Sinha
38939	Dhan Singh
38940	Shyama Pada Chowdhury
38941	Balbir Singh
38942	Som Nath Pruthi
38943	Shantappa Sadashivappa Patil
38944	Vinod Puri

STUDENTS (*contd.*)

No.	Name
38762	M. S. Ramaswamy
38763	Sudhakar Shankarrao Pangal
38764	Prem Chand Jain
38765	N. Ramanathan
38766	Gangadhar Tukramji Ingole
38767	Suresh Bhaskarrao Gandhi
38768	Kumarapuram Sivarama Ananthasubramanian
38769	Deo Dutt Sharma
38770	Narayan Pandurang Deshpande
38771	Prafulla Kumar Pal
38772	Srinivasachary Raghavan
38773	Manoharsingh Dyalsingh Advani
38774	Arvind Janardan Atre
38775	Narayan Vishnurao Walvekar
38776	Bhalchandra Shankarrao Deshmukh
38777	Arvind Dattatray Gokhale
38778	Surajbhan Babulal Sharma
38779	Mohinder Singh Sahni
38780	Shashikant Pandurang Sapre
38781	Kochupallikunnel Mathai Punnoose
38782	Ramaswamy Srinivasan
38783	Karuthedath Madhusudanan
38784	Vinay Kumar Malik
38785	Prabhakar Shamrao Godse
38786	Madhav Trimbak Gokhale
38787	Ganpat Raghunath Patil
38788	Mankarni Mulji Kabli
38789	C. K. Kunjukuttan
38790	Shankar G. Bhandarkar
38791	Niaz Ahmadchand Shaikh
38792	Suresh Sakharam Dandekar
38793	Jit Singh
38794	Padmakar Ramachandra Bhat
38795	Suresh Narayan Kulkarni
38796	Manohar Mukund Dandekar
38797	Mohinder Lal Chopra
38798	Balkeshwar Singh
38799	Piyushchandra Kesharichand Chudgar
38800	K. V. Purushothaman Namboodiri
38801	Vinodchandra Jagajivandas Shah
38802	K. Rama Warrier
38803	H. Subramonia Iyer
38804	T. Richard Williams
38805	C. V. Uthuppunny
38806	P. Venkitasubramoniam
38807	D. Janarthanan
38808	S. Thayasingh
38809	B. Gladstone Williams
38810	P. Krishnan
38811	N. Sasidharan
38812	L. Venkatesan
38813	V. Mohanakumaran Thampy
38814	L. K. Ramanathan
38815	P. Damodarannair Somasekharan Nair
38816	T. M. Philip
38817	M. C. Mathew
38818	Daniel Lukose
38819	K. Radhakrishnan Nair
38820	P. T. Thomas
38821	Sivasankarannair Ravikumaran Nair
38822	Harilal Jerambhai Chauhan
38823	Dhirendra Chandra Chakraborty
38824	K. P. Cheriyan
38825	Shankar Narhar Kale
38826	Satya Mitter Handa
38827	Chandrakant Vaman Limaye
38828	Kisan Ramchandra Thakre
38829	Arjun Marutirao Ingale
38830	Dakshina Ranjan Sil
38831	Chandrkant Dattu Janwekar
38832	Chandrakant Shivram Desai
38833	Bhaskar Gajanan Datar
38834	Krishanlal Charandas Gakhar
38835	Avinash Raghunath Phadake
38836	K. Srinivasan
38837	Surinder Mohan Kapoor
38838	Vidya Sagar
38839	Aloke Kumar Mukherjee
38840	Surinder Kumar Mahajan
38841	Krishnaraya K. Kamath
38842	Hari Krishan
38843	Sachchidanand Sahai
38844	Santosh Singh Thakur
38845	Ramesh Chander Bhargava
38846	Tarsem Lal
38847	Bansh Narain Chaudhary
38848	Triloki Nath Pandey
38849	Chhajja Singh
38850	Manohar Lal
38851	Gurdev Singh
38852	Kanwal Nain Anand

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No.	Name
38670	Vinukonda Venkata Annayya Sastry
38671	Param Lal Chaurasia
38672	Som Parkash Kapil
38673	Varinder Kumar
38674	Shaik Sahebjan
38675	Sudarshan Kumar
38676	Kurapati Sankara Rao
38677	Ravindra Nath Pathak
38678	Harbans Lal Jolly
38679	Vishnu Bokil
38680	Ranjit Singh
38681	Ramaiya Nagarajan
38682	K. C. Chandrasekharappa
38683	Jaysukhlal Bhaichand Mehta
38684	Bant Singh Saini
38685	Ramesh Kumar Joshi
38686	Surinder Pal Singh
38687	Vinay Kumar Chaturvedi
38688	Arun Govind Joshi
38689	Kashmiri Lal Goyal
38690	Satish Chandra Jaiswal
38691	Jagjivan Shamjibhai Halani
38692	Basant Kumar Kampani
38693	Ashok Ramchandrarao Ghatge
38694	Angara Venkata Rao
38695	Rameshchandra Amratlal Pancholi
38696	Angad Kumar
38697	Gurmukh Singh Kanthal
38698	Surinder Kumar Chopra
38699	Rajinder Kumar Sharma
38700	Sureshchandra J. Dhodapkar
38701	Jaswant Singh
38702	Ravinder Kumar
38703	Sat Pal Verma
38704	Tammineedi Venkata Rama Mohana Rao
38705	Rasikbhai Prabhudas Patel
38706	Dharm Parkash Kaushal
38707	Dalbir Singh
38708	Nirmal Singh Josan
38709	Kalattira Joyappa Belliappa
38710	Mocherla Rama Rao
38711	Kashmiri Lal Vijh
38712	Darshan Kumar Thukral
38713	Manohar Balkrishna Shukla
38714	Ranchhor Das Rathi
38715	Satish Chandra Vohra
38716	Kiritkumar Narandas Patel
38717	Trilok Singh
38718	Joginder Pal
38719	Vidya Bhushan
38720	Mohan Lal Bhatt
38721	Syed Akbar Husain
38722	Kalidindi Ramabhadri Raju
38723	T. Venkata Satyasiva Sankara Rao
38724	Rajendra Prasad Waghray
38725	Niranjan Kumar Aggarwal
38726	Prem Sagar
38727	K. Sukumaran Nampoothiri
38728	Shripad Dattatray Pendhakar
38729	Mukul Kumar Banerjee
38730	Damodar Dayal Gupta
38731	Mukund Narayanrao Patharkar
38732	Yoginder Kumar Girdhar
38733	(*Shrimati*) Saraswamma Krishnamma
38734	Baban Balkrishana Domkondwar
38735	Mukund Marutirao Deshpande
38736	Bhagwan Dass Munjal
38737	Kailash Chander Batra
38738	Krishan Kumar Suri
38739	Jyotirmoy Das
38740	Rattanlal Dulahdinomal Nathani
38741	Kaushal Nath Batra
38742	Bhaskar Shankarrao Pande
38743	Ramakant Shankarrao Chatpalliwar
38744	Jacob Philip
38745	C. S. Sathyaseelan
38746	P. G. Krishnan Nair
38747	N. P. Mustafa
38748	Bishamber Nath Malhotra
38749	Prem Nath
38750	Durgadas Ramchandra Bhende
38751	Daljit Singh Lalpuria
38752	Dwijendra Kumar Chanda
38753	Ram Lal Sharma
38754	Lakshmi Narain
38755	Ved Prakash Shandilya
38756	Harcharan Singh
38757	Kulwant Singh
38758	Prem Chand Srivastava
38759	Nagnath Landge
38760	Subodh Krishna Bhadra
38761	Sampige Raghavachar Kuppanna

STUDENTS (*contd.*)

No.	Name
38578	Kiranmay Mukhopadhyay
38579	Akundi Sitarama Swamy
38580	Hari Ram Gurjar
38581	Dilip Dattatray Chavan
38582	S. Bhoja Raju
38583	A. Balakrishna
38584	Prathivadibhayankara Kannan
38585	Raghunathrao Madhava Rao
38586	Bimal Chandra Kar
38587	Karenahalli Ramaiah Krishna Murthy
38588	Agara Subramanyaiah Nagaraj
38589	Sat Pal Rabra
38590	Gunvant Gangaramji Taide
38591	Hari Prakash Sharma
38592	Mangal Singh
38593	Amarjit Singh Saini
38594	Hargopal Singh
38595	Poundgoti Sheshagiri Rao
38596	Krishan Lal
38597	Kali Charan Agarwal
38598	Sham Lal Khanna
38599	Sunder Lal Bhatla
38600	Rajendra Prasad Agarwal
38601	Arvind Dattatraya Vyas
38602	Krishan Kumar Tayal
38603	Narendra Kumar
38604	Brijesh Chandra Bhatia
38605	G. Ramanujan Nair
38606	Mohinder Singh Dephu
38607	Drishan Murari Tandon
38608	Tulsi Dass
38609	Sant Lal Chugh
38610	Prem Singh
38611	Baldev Raj Manocha
38612	Virendra Kumar
38613	Yogendra Natwarlal Desai
38614	Abinash Chander Sharma
38615	Shiva Das Chaurasia
38616	Shridayal Jha
38617	Inder Lal Bhatia
38618	Jatinder Pal
38619	Surindar Kumar Aggarwal
38620	A. Ramachandran
38621	Sukhjinder Singh Bhatti
38622	L. S. Vydyanathan
38623	Shantilal Vithaldas Patel
38624	Chuni Lal Sethi
38625	Kanukhola Kameswara Sarma
38626	K. Sundaram Subramonian Iyer
38627	Kasaragod Gopala Krishna Shetty
38628	Nihal Chand
38629	Charanjit Singh Sandhu
38630	Brij Lal Gupta
38631	Ved Prakash
38632	Arjun Lal Quamrah
38633	Jagdish Rai Goel
38634	Ranbir Kumar Verma
38635	Harshadbhai Ramanlal Patel
38636	Thanikella Chandrasekhara Rao
38637	Jagjit Singh Chawla
38638	Santam Singh Lamba
38639	Devendra Vijay Khosla
38640	Sagar Ban Goswami
38641	Jagjit Ram
38642	Seshayee Bapty
38643	Ambalathandi Murugesan
38644	Sudesh Kumar Anand
38645	Hari Mohan Mittal
38646	Patimeda Narasimha Charyulu
38647	Mahesh Chandra Gupa
38648	Hrishikesh Sumanlal Pandya
38649	Vasant Pathak
38650	Pattamatta Hari Prasada Rao
38651	Sham Kumar
38652	Pramod Kumar Grover
38653	Krishan Lal Chadha
38654	Navinchandra Chandulal Patel
38655	Shagun Lal
38656	Dharm Paul Singh Lamba
38657	Ram Nath Verma
38658	P. Pandurange Veera Venkata Ratnam
38659	Sapidi Rayappa
38660	Kundan Lall
38661	Brij Mohan
38662	V. Venkata Narasimha Murty
38663	Bachchan Baboo Srivastava
38664	Ramakrishna Mahunt
38665	Dhirajlal Thakordas Parvadia
38666	Shyam Sunder Suri
38667	Bhikhubhai Dadabhai Desai
38668	Kishanlal Bodhraj Rajput
38669	Kanhyalal Malviya

STUDENTS (*contd.*)

No.	Name
38486	G. Vijayagopalan
38487	Virendra Nath Pandey
38488	Sattyavedu Kuppuswamy Kalyan
38489	Ramprasad Kisandas Sheth
38490	John Theodore Manuel
38491	Timir Kanti Bhattacharya
38492	Deepak Kumar Bhattacharya
38493	Paritosh Banerjee
38494	Arunansu Ray
38495	Brahmananda Tripathy
38496	Ajit Kumar Das
38497	Partha Pratim Mitra
38498	Hiranmay Chattopadhyay
38499	Madhusudan Sarkar
38500	Bhabanath Datta
38501	Alam Chand Biswas
38502	Sakti Ranjan Mitra
38503	Bhabani Prosad Ghatak
38504	Bikas Kumar Guha
38505	Sasanka Sekhar Samanta
38506	Pratul Krishna Chakravorty
38507	Prithvi Singh Pal
38508	Om Prakash Bakshi
38509	Gorapalle Narasimhalu Satyanarayana
38510	Ajjampodi Kotanagaiah
38511	Inderjit Ohri
38512	Valjibhai Vaktaji Garashia
38513	Narindar Kumar Vijra
38514	Sadananda Balaramamurty
38515	Ganesh Prasad Gupta
38516	Bangalore Nagesharao Srinivasa Murthy
38517	Mahinder Pal Munjal
38518	Surendra Pal Singh Khalsa
38519	Ajay Roy Chowdhury
38520	B. Lakshminarasimhaiah Sanjeevaiah
38521	Jai Lal Pammani
38522	Paresh Chandra Saha
38523	Din Dayal Agarwal
38524	Manohar Lal Sharda
38525	Shashank Yeshwant Dighe
38526	Shake Abdul Basheer
38527	Hari Shanker Misra
38528	Sharadchandra Dhundiraj Sapre
38529	Jaswant Singh Grewal
38530	Gogineni Krishna Rao
38531	Yash Pal
38532	Bhimisetty Krishna Murthy Setty
38533	Malluru Venkateswara Rao
38534	Murlidhar Bhagwandas Rawat.
38535	Ajit Singh Thukral
38536	Guruswamy Kesavan
38537	Byomkesh Bhattacharya
38538	Braham Dutt Sharma
38539	Ashok Kumar
38540	Jagannath Prasad Sharma
38541	Asish Kumar Ray
38542	Raghbir Singh Virk
38543	Gyan Prakash Srivastava
38544	Ramesh Chander Talwar
38545	Ram Nath Gupta
38546	Panambur Krishna Venkat Rao
38547	Suresh Chander Bhatia
38548	Upendra Lallubhai Patel
38549	Naresh Prasad Khare
38550	Mehu Ram Singla
38551	Vuppala Veerashalingam
38552	Mulakh Raj Khetrapal
38553	Chimatapu Subba Rao
38554	Gopal Krishan
38555	Surinder Kumar Sharma
38556	Virendrakumar Ganapatishanker Majumdar
38557	Gouri Shanker Namdeo
38558	Ram Krishna Verma
38559	Kotamraju Mohan Murali
38560	Kotamraju Rama Rao
38561	K. N. Chandrashekaraiah
38562	Shashikant Krishna Bhide
38563	Viraraghavan Sundararajan
38564	Sivaramaiyer Ganapathysubramanian
38565	Subrahmanyam Jayakumar
38566	Manjangarani Kumarakrishnan Jayakumar
38567	K. C. Krishna Murthy
38568	Kolakkur Venkatarao Venugopal
38569	Jivaji Donkar Gundu Rao
38570	M. Hanif
38571	Agaram Viswanath
38572	Subhas Chandra Gupta
38573	Rangachariar Kannan
38574	Mathuranayagom Nelson
38575	Mohammed Riazuddin Pasha
38576	K. R. Natarajan
38577	Shree Gopal Jhunjhunwala

STUDENTS (*contd.*)

No.	Name
38394	Rajendra Prakash Agarwal
38395	Ram Babu Gupta
38396	Yellapantula Venkata Kameswara Rao
38397	Dilip Kumar Ray
38398	Rohini Mohan Datta
38399	Nihar Ranjan Chatterjee
38400	Nimai Chandra Das
38401	Yajamana Deeshitha Raghavachari
38402	Kaniyur Neelakantan Ramakrishnan
38403	Subhash Chandra Kundu
38404	Niranjan Mitra
38405	Kulathu Sankaran
38406	Hiranmoy Bhattacharyya
38407	Suryanarayanasastry Gangadhara Sastry
38408	Subrata Ghose
38409	Pijushmay Das Choudhuri
38410	Nittur Rameswamiah Krishnaswamy
38411	S. P. Subramanian
38412	Murari Lal Nohria
38413	Arun Baran Kar
38414	Kasturi Srinivasan
38415	K. K. Janardhanan Nambiar
38416	U. Raghupathi Rao
38417	P. V. Subbanna
38418	G. S. Subramanyam
38419	Vikramajit Srivastava
38420	Hari Singh
38421	Kshounish Chandra Choudhury
38422	Lingisetty Ramamohana Rao
38423	Venigalla Janardhana Rao
38424	Kunigal Mohamed Ziauddin
38425	Simhadri Kameswara Rao
38426	Rama Prakash Tripathi
38427	Venkitram Raman
38428	Jnanatosh Dhar
38429	Sambaraju Venkata Krishna Rao
38430	Sankar Bhaduri
38431	Arabinda Maiti
38432	Bikas Chandra Mukhopadhyay
38433	Syama Prasad Mukhopadhyay
38434	Mriganka Kumar Mukherjee
38435	Samir Kumar Seal
38436	Pabitra Kumar Chakrabarti
38437	Utpal Kumar Mukherji
38438	Chittaranjan Dey
38439	Asoke Kumar Bhaduri
38440	Gora Majumder
38441	Pulak Chaudhury
38442	Madhusudan Vaman Kelkar
38443	Balai Das Shome
38444	R. Ramasubramanian
38445	Swadas Ranjan Sengupta
38446	Mysore Ramarao Madhava Murty
38447	M. Kalathi Subramanian
38448	Satya Deo Singh
38449	Anand Kumar Kansal
38450	Shesh Narain Misra
38451	A. V. Chellappa Reddy
38452	Kalavalapalli Venkata Ramana Rao
38453	Rishiraj Goyal
38454	Jagdish Prasad Gupta
38455	Ranjit Sen Gupta
38456	Sunil Kumar Chattopadhyay
38457	Yogendra Shanker Tripathi
38458	V. H. Venkitasubramaniam
38459	Padma Charan Gantyet
38460	Umesh Chandra Saharia
38461	Jaswant Singh Royat
38462	Karai Chinniah Balaram
38463	Satish Chandra Srivastava
38464	Ramesh Nath Kapoor
38465	Chandra Bhan Singh Ruhela
38466	Kuppam Ramanujam Yathindran
38467	K. A. Embrahim
38468	Kivaram Ramakotiah
38469	M. N. Nandhi
38470	Arunachalam Viswanathan
38471	V. Chandrasekharan
38472	Tapan Kumar Basu
38473	Dattatray Vinayak Rege
38474	Madhav Gopal Moharunkar
38475	Govindaraja Krishnan
38476	Ram Kishore Rajbanshi
38477	T. A. Krishnamurthi
38478	Amarendra Nath Pal
38479	Vigyan Vagish Dhaval
38480	Surjit Singh Chani
38481	Ramesh Chander Nanda
38482	Raghupathy Subramanian
38483	Kandoth Ravi
38484	Joginder Lal
38485	Surinder Pal Dedi

STUDENTS (*contd.*)

No.	Name
38302	Manohar Hari Tasgaonkar
38303	Virendra Kumar Jain
38304	Sachindra Nath Das
38305	Ajoy Kumar Ghosh
38306	Kantilal Chandulal Parmar
38307	Vishwa Nath Dwivedi
38308	Jacob Mathew
38309	K. Raghu Natha Rao
38310	Ram Kewalram Wadhwani
38311	Manohar Lal Sharma
38312	Shivaji Gurunath Kulkarni
38313	Lal Motiram Jiandani
38314	Battuluri Venkatasivaramaiah
38315	Ram Pal Singh
38316	Mohammed Abdul Rub
38317	Ramachander Vittal Kashyap
38318	B. Sreenivasa Rao
38319	Ramachandra Venkappa Devar
38320	Bogur Sadashivarao Ananda Rao
38321	Riaz Ahmad Shariff
38322	Bangalore Srikantiah Chandrashekar
38323	Saroj Kumar Roy
38324	Mohammed Zahiruddin
38325	Manohar Govindram Wadhwani
38326	Megh Raj
38327	Nitai Gopal Basu
38328	Gunadhar Paul
38329	Pranab Kumar Dey
38330	Siruvolu Purushotham Rao
38331	Harbir Singh
38332	Anadi Ranjan Banerjee
38333	Raj Pal Arora
38334	Ghanshyam Sadhuram Bhatia
38335	Shankar Tippurao Ambore
38336	Ranjit Kumar Ray
38337	Shrikant Kanhyalal Khinvasara
38338	Harjinder Singh
38339	Govind Chatoomal Nasta
38340	Vidya Bhushan Asthana
38341	Kurapati Jagadeswara Chetty
38342	Ram Krishan Sharma
38343	Ramaswamy Natarajan Iyer
38344	Prithvi Raj Johar
38345	Balwant Singh Tomar
38346	Raghupathy Naidu
38347	Donthi Sathyanarayana Gupta
38348	Pillaipakam Bahukudumbi Krishnamurthy
38349	R. D. Vinayagam
38350	Satyendra Nath Paul
38351	Ajoy Kumar Gupta
38352	Vegamangalam Sambanda Rajeswaran
38353	Tirupanandal Ramadurai Vaidyanathan
38354	Surendra Chandra Kalita
38355	Chimlakonda Purniah
38356	Krishnaswamy Kasturi Rangan
48357	Dantuluri Gopala Krishnam Raju
38358	Kewal Krishan
38359	Bal Raj Jain
38360	Madiwalappa Siddappa Narasalagi
38361	Makhan Lal Ganjoo
38362	Gopalanandan Mudaliar
38363	Auckland Anthony Rodrigues
38364	Kumaraswamy S. Rao
38365	Birendranath Parial
38366	Jagadeesamudaliar Masilamani
38367	Kothamangala R. Subramanya Iyer
38368	Pawan Kumar Gupta
38369	Khadernaik Mohamad Naveemur Rahman
38370	Amar Singh Chauhan
38371	Kancharla Prabhakara Rao
38372	Chintada Venkateswara Rao
38373	N. E. Raghupathy
38374	S. S. Krishnan
38375	Pylla Sudarshan Reddy
38376	Mare Ganga Reddy
38377	Bishnu Prasad Shrestha
38378	Angarai Natarajan Chandrasekaran
38379	Jallapuram Srinivasa Murthy
38380	Narayanasamy Subramanian
38381	Shailendra Prakash Sharma
38382	Chilakamarri Ramanujacharyulu
38383	Balasubramanya Vishwanath
38384	Devindar Singh
38385	Raveendranath Malharrao Godhindi
38386	Kuppa Venkataramana
38387	Koyambron Sudhakaran
38388	Subbarama Venkatraman
38389	Govindasamyreddy Padavati
38390	M. Tukarama Pai
38391*	Venkataraman Ramachandran
38392	Ram Bharosey
38393	Dhanvant Chimanlal Parikh

section of the book are practical descriptive matter, principles of action in the constructional features of heat engines, and practical aspects of steam power plants and information relating to laboratory procedure and technique.

PUBLICATIONS RECEIVED

A publication No. 19, entitled 'Deflections of Portal Frames' has been received from the British Constructional Steelwork Association, Artillery House, Westminster, London, S.W.1. This publication deals with deflections of portal frames with a fixed base, and transverse deflections of portal frames with several illustrative examples.

The Proceedings of the Conference on 'Housing from the Factory' held in London in October 1962, under the auspices of the Cement and Concrete Association, has been received from the Cement and Concrete Association, 52 Grosvenor Gardens, London, S.W.1. The Proceedings contain papers presented at the Conference and a lecture given to the Prestressed Concrete Development Group of the U.K.

LIST OF NEW ELECTIONS AND TRANSFERS

(Continued from Bulletin for March 1963)

STUDENTS

No.	Name	No.	Name
38266	Navaloor Jayachandran	38284	Adki Madhusudhan Rao
38267	Nemali Sreenivasan Soundararajan	38285	Kalvampara Ayyappankunji Sadasivan
38268	Ranganathan Narayanan	38286	Thiruvengidathu Rajagopalan
38269	Pochana Ramachandra Reddy	38287	Doraiswamy Janardhanan
38270	Jacob Mammen	38288	Tenneti Venkata Kameshwara Rao
38271	Arockiam Ignagi	38289	Umesh Raghunandan Shenoy
38272	Shaik Abdul Azeem	38290	Satish Chandra Agrawal
38273	Chakravarthy Sundararajan Santhanam	38291	Gopal Krishan Agarwal
38274	Sakkottia Srinivasaraghavan	38292	Jagmohan Prasad Maskara
38275	Vallury Sanjeeva Rao	38293	Gajanan Sadashiv Pikle
38276	Vuyyuru Kata Reddy	38294	Ram Gopal Asthana
38277	Venkataraman Kalyanam	38295	Ramesh Chander Kataria
38278	G. Ganesan	38296	Kandukuri Venkata Subba Rao
38279	V. Srinivasan	38297	T. T. Isaac
38280	Srinivasa Subramanian	38298	Baradhalwar Balaraman
38281	Mocherla Nataraj	38299	Mohinder Singh
38282	Lakshmanan Bhoopalan	38300	Suleman Gulammohamed Dudhwala
38283	Poovala Govindarajulu Ranganathan	38301	Narayan Anant Yevale

architectural and engineering activities and other allied arts. The plates are, in fact, prepared for the 'History of Ancient Indian Architecture' which is being written by the author. Although, all illustrations have been drawn to scale, the scale has purposely been omitted to discourage students from mere repetition, the principal aim being to inspire them to develop original ideas and independent proportions of architectural feature for which the ancient Indian architects were specially distinguished.

2. **Hydraulics.** N. S. Govinda Rao. *Asia Publishing House*, Rs. 22. 412 pages.

Intended to be equally useful to students and engineers in the field, this comprehensive treatise deals with all aspects of the flow of liquids, giving the necessary background knowledge of hydrodynamics and dimensional analysis. The author does not presume a knowledge of mathematics on the part of the student above the elements of calculus. Appended with an exhaustive bibliography, the book comprises a multitude of worked out examples together with a host of problems (with answers) listed for solution.

3. **Fluid Mechanics**—vol. 1. M. Manohar. *Asia Publishing House*, Rs. 22. 418 pages.

This books gives a judicious treatment of fluid flow from the points of view of the applied and theoretical aspects. This is achieved by building upon elementary mathematics, physics and mechanics. Illustrative examples included clarify the applied aspects of the subjects and the limitations of the theories. While providing a good base for advanced work on the subject the book serves as a reference volume.

4. **Estimating & Costing in Civil Engineering.** B. N. Dutta. *Published by the author, Tagore Palli, Motilal Bose Road, Lucknow*, Rs. 14. 4th edition. 524 pages.

This fourth, revised and enlarged edition of the book gives a comprehensive account of estimating and costing with illustrative examples of common structures such as buildings, roads, culverts and wells, etc. The author has also included details of contract work and analysis of rates, and detailed specifications of standardization of work in both F.P.S. and metric systems. New chapters on metric system, R.C.C. works, methods of measurements, and village housing included in this edition make the book invaluable to students and engineers.

5. **Engines.** D. H. Marter. *Asia Publishing House*, Rs. 12. 264 pages.

This book deals with many types of engines including Diesel, petrol and steam engines, gas and steam turbines, and associated power plant free-piston and NSU-Wankel engines, and air compressors. Ample illustrations and explanations have been incorporated in the text to make the necessary meaning clear to the layman while the interest of the serious student has been safeguarded.

6. **Thermodynamics and the Heat Engine.** D. H. Marter. *Asia Publishing House*, Rs. 28. 811 pages.

This book, intended to provide a text suitable for use in the initial courses of study on heat engines, follows the present day approach and stresses the importance of the thermodynamic system and its application to processes of energy conversion. Concepts of entropy and reversibility are dealt lucidly, and the utility of entropy planes in the solution and understanding of problems is explained. Included in the last

About 600 delegates from different industrial and commercial organizations; scientific, research and technical institutions; and Central and State Government Departments are expected to participate in the Convention. Delegates from foreign countries are also expected to attend the Convention. Further details regarding the Convention can be obtained from the Indian Standards Institution, 9 Mathura Road New Delhi 1.

Sixth General Assembly and Technical Committee Meetings of the International Organization for Standardization, New Delhi, November 9-21, 1964

The International Organization for Standardization (ISO) will hold its Sixth General Assembly and Technical Committee Meetings in New Delhi from November 9-21, 1964. The Indian Standards Institution which represents India on this organization extended an invitation to hold the meeting in India. The meetings will be organized with the concurrence and financial support of the Government of India. Indian industry will also be associated with the organizing and financing of the meetings.

Delegates from 47 member countries of ISO are expected to attend the meetings. Important technical committees of the organization dealing with subjects of interest to India including steel, manganese ores, solid minerals, fuels, mica, light metals and their alloys, machine tools, rubber, agricultural food products, measurement of fluid flow, building construction, sheet and wire gauges, standard marks, pictorial markings for handling of goods and personal safety protective clothing and equipment, will hold their meetings at the time to discuss matters relating to international standardization, with the ultimate objective of industrial development in different countries and facilitating promotion of international trade in goods and services.

Sixth International Conference on Soil Mechanics and Foundation Engineering, Montreal, Canada, September 8-15, 1965

The Sixth International Soil Mechanics Conference will be held in Montreal, Quebec, from September 8-15, 1965. Meetings will occupy the first three days, and September 11 and 12 will be used for excursions for those who wish to participate; meetings will resume on The 13th and the proceedings will terminate at the morning session of September 15, 1965. Further details of the Conference will be published in the *Bulletin* from time to time.

BOOK ACKNOWLEDGMENT

1. **Indian Architecture.** B. L. Dharma. *Published by the author, 'Swastika House', Station Road, Jaipur,* Rs. 12.50. 34 pages.

This book, consisting of a number of plates, contains architectural details of some ancient Indian monuments of reknown, is intended to be useful to people engaged in the information which can be obtained for administrative purposes); (iii) Auditing of receipts; (iv) Compilation of pay bills and pensions; (v) Supplies and stores management; and (vi) Supervision of certain kinds of traffic, seat reservation and other problems.

4. Definition of the mathematical methods and operational research procedures to be used in the solution of transport problems by electronic computers: (i) Linear and dynamic programming systems; (ii) Probability calculus and statistical methods applied to operational research, etc.; (iii) Application of such methods to general transport planning; and (iv) Determination of an optimum method of routing freight traffic and distribution of traffic between the various forms of transport.

5. Technical facilities for data processing and transmission: (i) Organization of calculation centres; (ii) Requirements to be laid down for electronic computers used on the railways; (iii) Systems for the remote transmission and automatic gathering of data: transmitters and receivers, requirements to be laid down for transmission channels, methods of coding data and improving the reliability of its transmission over existing channels; and (v) Systems for automatic data reading, with particular reference to the identification of moving vehicles.

The working languages for the Symposium are: French, English, Russian and German. Papers for the Symposium should be submitted to the UIC General Secretariat before July 15, 1963. Members who wish to contribute papers may send their manuscripts to the Headquarters of the Institution well before the above date.

Eighth Indian Standards Convention, Ahmedabad, December 22-28, 1963

The Eighth Indian Standards Convention will be held at Ahmedabad from December 22-28, 1963. Shri K. C. Reddy, Union Minister for Commetce and Industry and President of the Indian Standards Institution, will preside over the inaugural function on December 22, 1963.

The Convention will discuss subjects of topical interest in the following eight technical sessions.

1. Role of Standardization in the National Emergency,
2. Quality Control in Textile Industries,
3. Standardization of Materials ~~Used in~~ Textile Processing,
4. Standardization in the Field of Textile Machinery and Mill Accessories,
5. Progress of Changeover to Metric System in Industrial Production,
6. Role of Laboratory and Operational Research in Standards,
7. Standardization in the Dairy Industry, and
8. Precious Metals Industry and Standardization.

Symposium on 'The Use of Cybernetics on the Railways', Paris, November 1963

A Symposium on 'The Use of Cybernetics on the Railways', organized by the Union Internationale des Chemins de Fer, will be held in Paris in November 1963. The general aim of the Symposium is to organize a wide exchange of experience and ideas and to facilitate the search for the best solutions to the problems raised by the use of cybernetics on the railways. Resort has already been made to cybernetics in a number of railway spheres and the value of this branch of science will be appreciated more and more as time goes by. Much theoretical and practical research has already been carried out, especially in the U.S.A., the U.S.S.R., Japan and Europe.

The railways had already acquired a certain experience in the use of punched tape equipment before having recourse to electronic calculators and now a number of networks have begun to apply cybernetics to certain administrative tasks, such as revenue accountancy, statistics, payroll operations, etc., but often without radical changes being made in the procedures followed. However, studies and practical research on the use of cybernetics for solving railway operating problems, *viz.*, plotting train running diagrams, distribution of wagons, traffic control, etc., are still lacking on the networks as a whole. The application of cybernetics to railway problems can entail the use of various methods and could lead to quite different solutions. It is nevertheless necessary to achieve a coordination of all the procedures involved so that full benefit can be derived from cybernetics, *i.e.*, from a large organization, and applied to all the operations for which automation is sought: marshalling, traffic control, distribution of rolling stock, statistics, etc.

For these reasons and in accordance with the recommendations made by the group of experts appointed by the Economic Commission for Europe at Geneva to study certain railway technical questions, the International Union of Railways has decided to organize an International Symposium on 'The Use of Cybernetics on the Railways'. The Symposium will be held in five sections as follows:

1. Problems of automation associated with the control of all aspects of railway operation: (i) Use of computers for the compilation of train formation diagrams and in planning the distribution of traffic between marshalling yards; (ii) Calculation of typical train running times; (iii) Compilation of train running diagrams, engine diagrams and staff rosters; (iv) Studies relating to line capacity and transport potentialities; and (v) Control of the whole process of railway operation, including rolling stock distribution, etc.
2. Automation in the control of autonomous procedures: Use of electronic computers for train running, control, supervision of station and marshalling yard working, driverless train operation, etc.
3. Application of computers to railway management problems: (i) Methods of obtaining operational, statistical and accountancy data; (ii) Integrated data processing for the fields of management (research in connection with

working in the allied fields desirous of presenting papers at these Symposia should send two copies of abstracts of not more than 300 words by July 31, 1963, to Dr. N. U. Rao, Convenor, Symposia, Central Public Health Engineering Research Institute, Nagpur. Papers submitted for the Symposia in response to the announcement made in the August 1962 issue of the *Bulletin* may also be presented now.

1963 Corrosion and Metal Finishing Exhibition, Leeds, October 15-18, 1963

The 1963 Corrosion and Metal Finishing Exhibition, the fifth to be held since 1957, will be staged in Leeds during October 15-18, 1963. Technical meetings arranged by national organizations, a regular feature of these exhibitions, will be organized in Leeds by The Institute of Metal Finishing, The Corrosion Group, Society of Chemical Industry, The Plastic Institute, and The Zinc Development Association.

Further details regarding the exhibition can be obtained from The Organizers, Corrosion and Metal Finishing Exhibition, The Tower, Shepherds Bush Road, Hammersmith, London, W.6.

The 1963 International Building Exhibition, Olympia, London, November 13-27, 1963

The 1963 International Building Exhibition will be held in Olympia, London, from November 13 to 27, 1963. The theme of the exhibition is 'Industrialized Building'. All the contributing government departments will concentrate on showing their work in research and development for industrialized building.

The Ministry of Public Building and Works, U.K., will be coordinating the work of development groups in the Ministries of Housing and Local Government, Health and Education, all of whom carry out research on industrialized building. The research and developments group of the Ministry of Housing, U.K., have already designed and built, in partnership with Sheffield City Council, four prototype houses in a light weight industrialized system. This system will be displayed at the Exhibition.

Local authorities are forming consortia to pool knowledge of new techniques and materials and to set up organizations capable of placing large contracts. Manufacturers are invited to make their own contributions to this important subject in the display of their products and the design of their stands. Their exhibits can fit in with the theme of industrialized building in many ways—factory-made components, heavy or light prefabricated building systems, standardized dimensions, quality control and site mechanization—to provide a cross-section of the industry's progress towards greater productivity.

Further details regarding the Exhibition can be obtained from The Building Exhibition, 11 Manchester Square, London, W.1.

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION B (*contd.*)

Roll No.	Name of candidate	Roll No.	Name of candidate
1537B	Desh Bandhu Chawla	1638B	Savanta D. Yadav
1542B	Hari Krishan Babber	1641B	Dhiraj Kanti Roy
1556B	Madan Pal Singhal	1642B	Shrikant Ganesh Thatte
1561B	D. P. Singh Azad	1646B	Sudhakar Bajirao Upasani
1562B	V. R. Ganesan	1651B	Narinder Pal Kumar
1565B	Madan Mohan Prasad	1657B	Vasant Mahadeo Apte
1582B	Amar Narain Tandon	1662B	Damodar Anant Khare
1609B	Ac Karnail Singh	1663B	Vasant Keshav Godse
1616B	Krishnaji Mahadeo Lagu	1670B	Gurdial Kohli
1619B	Vasant Dattatraya Dake	1673B	Dhir Singh Panwar
1623B	B. S. Pattanshetti	1675B	Ramdhir Ramavtar Maini
1625T	P. T. Sharangpani	1682B	A. V. Thomas
1631B	Shivaram Laxman Jatkar	1687B	L. S. Iyer
1633B	Prabhakar Govind Joshi	1691B	C. T. Pillai Kolappa Pillai

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION B
(New Scheme)

Roll No.	Name of candidate	Roll No.	Name of candidate
Civil		*Chemical*	
27NB	Mohammed Usman Saheb	6NB	Swadesh Kumar Bhargava
30NB	Laxmichandra T. Mathur		

INSTITUTION NEWS

International Recommendations for Grout and Grouting of Prestressed Concrete

The Federation Internationale de la Precontrainte, Terminal House, Grosvenor Gardens, London, S.W.1, have now published the final report of the joint FIP-RILEM Committee on Grout and Grouting of Prestressed Concrete under the chairmanship of Prof. Inge Lyse in the form of 'International Recommendations for Grout and Grouting of Prestressed Concrete'. Copies of this document can be obtained from the above office, at 1s per copy.

FORTHCOMING CONFERENCES

Symposia on (i) 'Waste Treatment by Oxidation', and (ii) 'Public Health Engineering Education', Nagpur, October 29-31, 1963

Under the auspices of the Public Health Engineering Division of the Institution of Engineers (India) and the Central Public Health Research Institute, Nagpur, two symposia on (i) 'Waste Treatment by Oxidation', and (ii) 'Public Health Engineering Education', will be held at Nagpur from October 29-31, 1963. Engineers and scientists

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION B (contd.)

Roll No.	Name of candidate
949B	Parasa Anand Rao
960B	Velivelli Veeraswamy
964B	Kalutla Subbanna
993B	Tipirneni Ramamohan Rao
1004B	Harbans Singh
1005B	Ram Partap
1006B	Mahadeo Prasad Srivastava
1009B	Anilkant Manibhai Patel
1016B	Bhagwan Singh Naga
1024B	C. V. Prasada Rao
1039B	Brij Mohan Dutta
1040B	Surendra Lal Jain
1042B	Cyril Albert Robinson
1046B	Prithvi Singh Gahlot
1063B	Man Mohan Singh
1066B	Bhupendra Kumar
1067B	Prabhash Chandra Mangal
1077B	Dharni Dhar Choudhary
1090B	Sat Parkash
1100B	Kapil Dev Kharbanda
1112B	Rana Pratap Gulati
1113B	Mahendra Pal
1114B	Balwant Raj Bhasin
1121B	Subhash Chander
1127B	Anand Prakash Gupta
1128B	Saiyid Khurshaid Husain
1134B	Sudesh Kumar
1138B	Dinesh Kumar Srivastava
1139B	Kailash Nath Tandon
1142B	Panna Lal Goyal
1156B	Salek Chand Jain
1157B	S. Nagarajan
1167B	Jatinder Lal Hans
1170B	Madan Mohan Lal
1184B	Avadhesh Singh
1185B	I. A. Tiruvenkata Swami
1190B	Narendra Nath Palai
1192B	Prafulla Kumar Sahoo
1195B	Padma Charan Khuntia
1197B	C. V. Subramanian
1211B	Sudersan Subodhi
1212B	K. Ganapathi
1216B	N. V. Gurumurthy
1220B	Sadineni Kanakaiah
1222B	M. V. Ganesan
1224B	Javvaji Venkatrama Rao
1239B	Sitharamiah Rajagopal
1243B	Srinivasan Parthasarathi
1249B	Tallapragada Lakshmipathi
1260B	Padmanabhuni Jogarao
1276B	V. S. S. Krishnan
1278B	P. R. K. V. Nagendra Rao
1290B	N. C. Sampath
1295B	Pinjala Kota Subbarayudu
1300B	A. K. Krishna Menon
1305B	M. V. Narayanareddy
1306B	Dereddy Ravi Kumar
1315B	Kandasamipillai Narayanan
1316B	M. Veerabhadra Rao
1319B	T. Venkataramana Reddi
1325B	P. C. Joseph
1329B	S. Sundara Rama Aiyer
1330B	Krishnaswamy Vasu
1331B	Yerasi Narasimha Reddy
1332B	P. Lakshmi Narayan
1334B	Pilaka Ramana Maharshi
1336B	Kakani Madhava Rao
1337B	Bhuvarahan Raghavan
1380B	K. Balakrishnan
1382B	Krishnaswami Ramachandran
1393B	K. Renganathan
1412B	A. S. R. P. V. S. Raju
1431B	B. V. R. Rao
1433B	E. K. Viswanathan
1449B	C. A. J. Venkatachalam
1457B	Mukund Govind Gokhale
1462B	Sukhdev Parshad Chopra
1464B	L. Narain
1466B	Gurdev Singh Chaggar
1477B	Milkha Singh Chouhan
1479B	Harbans Sharma
1480B	Resham Singh Pandori
1485B	Gurdayal Singh Gulati
1490B	Dev Raj Singla
1496B	Ved Prakash Gupta
1498B	S. P. Midha
1507B	Bhupindar Singh Ahuja
1518B	Ramesh Chand Lumba
1520B	Charanjit Singh
1522B	Ram Nath Goyal
1524B	Harish Chander Gupta
1532B	Pitamber Datt Sharma

Equally important is the setting up of a good library. Books on technical subjects are rather costly and an average engineer cannot buy a large number of books. We have therefore to provide good technical libraries. This will be of great help not only to students appearing for Institution examinations, but also to Corporate Members for day-to-day references. I take this opportunity to make an appeal to all our members as well as the public to donate generously to the library fund. Contributions in the form of books also will be of great help.

Gujarat is a deficit State not only in finance but in all items necessary for the community as a whole. It has no inland waterways. It has, however, a vast coast line and a large number of intermediate and minor ports. These ports handle about 40% of the total cargo in the country. Setting up new industries depends much on the development of these ports.

Again, Gujarat has not the advantages of an important inland air service or an international air route. The air ports of the State are not designed for frequent and successful operation of large airliners.

India is perhaps a rare exception where railways have three distinctive gauges. This fact is very conspicuous in Gujarat. Even in the case of small distances, the commodities have to be shifted from wagons of one gauge to those of another and sometimes for a second or third time. A beginning has to be made immediately to abolish the narrow gauges and replace the same by the gauges of the main lines which they connect. If this is done, a number of short links can be established, which will make the journeys shorter and cheaper and also link most of our towns directly with the others by a single gauge.

No new important railway tracks have been laid after independence in Gujarat, except the Kandla-Deesa line and the Himatnagar-Udaipur section which is under construction at present. There has been a great demand for broad gauge connections between Ahmedabad and Kandla and Tarapur and Bhavnagar. Likewise, Baroda deserves to be connected by metre gauge lines with other parts of the State. A large amount of money paid by the former Baroda State many years ago for this purpose still lies with the Railway Board.

Roads provide one of the major means of transport. The network of roads in India is very meagre. Our road mileage on the basis of population and sq. mile of habitated area is perhaps the minimum amongst the civilized nations of the world. While France and Great Britain have 360 and 202 miles per 100 sq. miles, we in India have hardly reached a figure of 29 miles so far. While Austria and Canada have 5,285 and 3,130 miles of road per 100,000 men, we have only 98 miles.

The Nagpur Plan was prepared in 1943 and the targets set out in this plan with regard to the mileage of roads for the whole of India were fulfilled in 1961. We have reached a total of 144,000 miles of *pucca* roads as against a target of 127,000 miles and 235,000 miles of *kutcha* roads as against a target of 208,000 miles.

We had in Gujarat a total of 8,135 miles of road in 1951, *i.e.*, at the beginning of the First Five Year Plan, 3,725 miles of which were *kutcha*. According to the Nagpur Plan, we should have 9,751 miles of *pucca* roads and 14,556 miles of *kutcha* roads. At the beginning of the Second Five Year Plan, we had 11,098 miles of road which mileage was still in deficit by 45%. In 1961, at the beginning of the Third Five Year Plan, we reached a figure of 14,482 miles, which is 40% short of the fixed target. A total allocation of Rs. 16.7 crores has been made for the roads in the Third Five Year Plan. It is estimated that the total mileage of roads will reach 16,000. We will still have a deficit of 35% in 1966.

The picture of road development in Gujarat is thus very grim. Something radical will have to be done. The 20-Year Road Development Plan (1961-81) proposes to increase the incidence of roads per 100 sq. miles from 26 miles (according to Nagpur Plan) to 52 miles. Then Gujarat will have to increase its present mileage from 14,482 to 34,188. This means that the new mileage of roads that will have to be constructed up to 1981 will be 20,000 approximately. Even then, the rate will be 49.3 miles per 100 sq. miles, as against 52 miles for the whole of India. To achieve this, an amount of Rs. 285 crores will be necessary. Leaving aside Rs. 45 crores required for the developments of National Highways within the State, the State Government will have to arrange for Rs. 230 crores to fulfill this obligation. For this, adequate allocations will have to be made in the future Five Year Plans.

The 20-Year Road Development Plan aims at bringing a metalled road within 4 miles and a *kutcha* road within 1½ miles of each village. The cost of providing such a large network of roads will be heavy. When such a large expenditure has to be incurred, it is prudent to ensure that the roads are sufficiently used so as to pay back the cost. Road construction then becomes self-financing. This position has been attained in a number of advanced countries. In our rapidly developing economy, the funds available are not plentiful, with the result that each sphere of activity receives a restricted allotment. Road development is not an exception to this. It is thus not possible to provide roads suitable for heavy vehicles out of this fund.

Heavy vehicles with trailor combinations can cut road transport costs considerably, but such vehicles require roads with a thickness of hard crust of the order of 18 to 20 in. as against the present thickness of 10 to 12 in. They also require superior surfacing and lastly they cannot ply with safety on a single lane width of 12 ft.

The usual method of road construction consists of forming a bank with the soil available along the road alignment. The thickness of the road crust is arrived at on the basis of a thumb-rule, 6 in. thick soling with rubble stone or one or two layers of brick, say, and a wearing coat of road metal, 4½ to 6 in. thick. The surfacing is rarely of a superior nature such as a dense bituminous carpet or a rigid pavement of cement concrete. This design was adequate for the light traffic in the past. With heavier loads now coming on the roads, this crust thickness is now inadequate. It is therefore, necessary to make use of all the components of roads, including the soil, to obtain the most economical design. The soil bank has to be compacted scientifically to 90 to 100% of Proctor density.

The failure of roads does not take place due to the intensity of an isolated heavy load. It is the repetition of such loads that brings about the failure. The thin crust of the present road pavements have stood the traffic so far only because the number of repetitions of heavy loads is still low. This however will not last long. Several arterial routes have already started showing signs of distress and the road surfaces are getting deformed rapidly.

The thickness of the road crust depends on the C. B. R. value *i.e.*, the bearing power of the soil. For a poor soil having predominance of clay particles, the C. B. R. value may be 2 to 3%. The thickness of the road crust even for medium traffic would be 27 in. For the same traffic condition, the thickness required is 13 in. only if the C. B. R. value of the sub-grade is 8%. This shows how essential it is to get a high C. B. R. value from the soil. The soil can be improved either by mixing it with granular material or by treating it with cement, lime or other additives. It is cheaper to improve the soil than to provide full thickness of crust over a poor soil. In a modern road, therefore, earth formation is an important component of the structure as a whole. Compaction or stabilization of soil plays an important part in preparing low cost roads, which may be formed with earth and gravel only. Considering that there is large unemployment in the country, it will be possible to obtain the requisite manual labour for the construction and maintenance of low cost roads. Mechanized construction will produce a superior type of road crust, but we cannot afford to sit idle till we produce equipment required for this type of work.

Another aspect of the design of roads is the width of pavements. No attempt has been made so far to provide a width in accordance with the needs of traffic. This is partly because the volume of traffic is still somewhat low, but the chief reason is the paucity of funds. Delay in this work is bound to lead to increased tole of life from traffic accidents. No road in our State also conforms with these requirements. Even the National Highways are far from satisfactory. A good length of the Highway still requires to be provided with a dust proof surface. The Narmada bridge is another big bottleneck.

In irrigation also, Gujarat lags behind other States. The State has a total cultivable area of 26.78 million acres. Of this, only 159,000 acres had irrigation facilities prior to the First Five Year Plan. This shows that this State was totally neglected during the pre-independence period. The additional irrigation potential created during the First Plan by major and medium projects was 58,200 acres only. The irrigation potential likely to be created under these schemes at the end of the Second Plan period will be about 581,300 acres. The total area for which irrigation facilities are likely to be provided by the end of the Second Five Year Plan by major and medium irrigation schemes will constitute about 2.5% of the total cultivable area of the land in the State.

Thirty-three major and medium irrigation projects were taken on hand in the First Plan period. None of them was completed during that period. Twenty-three new schemes were taken up in the Second Plan. Of these 56 schemes, only six were envisaged for completion during the Second Plan and 50 schemes have been carried over in the Third Plan. Some of the larger projects included in the Second Plan are not likely to be completed in the Third Plan also obviously due to shortage of funds. Irrigation benefits from these schemes will not be available even at the end of the Third Plan. Even after accounting for the irrigation benefits that are likely to accrue on completion and full development of all these major and medium schemes, the percentage of land under irrigation to the total cultivable land will be 12.7% only, which is far behind the present conditions in the rest of the country.

At least, most of the medium schemes started in the First Plan should be completed without any further delay. It may be noted that although the total irrigation potential that is likely to be available at the end of the Second Plan is 876,800 acres, actual irrigation facilities are made available to 312,400 acres only. The problem of utilization of irrigation waters, made available by the major, medium and minor irrigation schemes in the State, should seriously engage the attention not only of engineers but of economists and agricultural experts.

Some of the rivers of our State overflow their banks during heavy floods and cause considerable havoc to life and property. Floods in the Tapi and the Narmada as well as in the rivers of Saurashtra are quite fresh in our minds. We have not been able to do anything substantial to prevent the occurrence of such floods. It is also a tragedy that there are some areas in our State where water is scarce.

An interlinking of rivers on a regional basis seems to be a necessity not only for the prevention of floods but also from the point of an even distribution of water resources, thus bringing larger areas under irrigation. Incidentally, this will also help in providing adequate water supply to a number of towns and villages.

The basic need for industrial development is electric power and Gujarat suffers an acute shortage in this respect at present. The Central Water and Power Commission has estimated that the total load demand in Gujarat State by the end of the Third Plan would be of 520 MW. The total output including additional installations planned for the Third Plan period will be 287 MW, thus indicating a deficit of 233 MW in 1966.

The Dhuvaran thermal power station will start functioning in 1964. This station will have four turbo alternator sets of 50/62.5 MW each. The firm capacity of this station will be of the order of 200 MW. We will thus have a deficit of about 33 MW at the end of the Third Plan. Actually, this deficit is likely to be much more, as the rate of consumption of electric supply has been assumed to be much less than in other States. We do not know when we will start getting power from the atomic power station proposed to be installed at Tarapore in Maharastra. It will therefore be appropriate to increase the capacity of the Dhuvaran and other thermal stations.

No hydro-electric power is produced at present in the State. There are possibilities in three major irrigation schemes for the development of cheap and economic hydel power. These are Ukai (110,000 kW), Kadana (15,000 kW) and Narmada (650,000 kW). None of these projects is expected to provide any power at the end of the Third Plan. It is however expected that these schemes when completed will provide adequate power for the development of the State.

The Chinese aggression has created a critical situation. This may result in partial modifications in the Third Five Year Plan proposals. The State Government may be required to curtail its provisions in some items. We hope that such curtailment will not be applied to the most essential services like transport, irrigation, power, etc.

Oil has been found at several places in our State and the prospects of getting oil in large quantities are very bright. The State Government should not rest content only with the royalty on oil, but should request the Centre to establish a number of petro-chemical industries in the public sector in partnership with the State.

Our progress depends on the availability of specialist consulting engineers. It is rather unfortunate that large sums of money are being spent in the form of foreign exchange, by entrusting the work of design to foreigners even in the case of small projects. Although there are only a few Indian consulting firms, we have a number of good engineers, who, though they have retired from active duty, can give valuable help in the design and scrutiny of large engineering projects. The services of such engineers must be made use of. It is time that our universities and engineering colleges concentrate on designs as a speciality. Post-graduate courses must be introduced in the engineering curricula in order to produce design and consulting engineers.

The engineer in the country has been given a secondary place in the Governmental set-up. Scientists and engineers have yet to be given their due place, prestige and security as well as freedom to pursue their vocations without fear or favour. We are often told that this is an age of science and technology, but, in practice, the climate is far from conducive to a rapid and unhindered growth of economic development. Engineers face at present many impediments and handicaps and these must be eliminated before they can fulfil their role adequately.

Engineering has been defined as the art of directing resources of nature to the use and convencience of mankind. An engineer has to understand the laws of nature. He has to organize and direct the knowledge of science and technology as well as resources of men, materials, and machines to achieve a preplanned and specific aim. Every engineering activity has a clear and immediate purpose, the achievement of which demands planning, decision and control. The basic training and subsequent experience, which are normal for the professional engineer, should be suited to the development of good managerial qualities.

Engineering is basically management and engineers are most suited for top management posts in predominantly engineering projects and departments. The direction of technical departments is best delegated to them both in the technical and administrative spheres. Technical men alone are competent to take final decisions.

Very few engineers are being utilized in the field of senior management in the private and public sectors. The subordination of the technician to the mere administrator is rather an anamoly. Administrators may at times form the stumbling block in the name of control and discipline. The engineer's posittion in the present set-up is that he is made responsible for the achievements of targets without being given the necessary authority.

Engineers are still not found at policy making levels. They are not being called upon to assist the leaders directly for making constructive decisions. Very few engineers have taken to politics so far. I do not see any reason why engineers like other professional men should not contest for the Parliament, the State Assemblies and other policy making bodies, so that they have a chance to contribute the engineering point of view on different problems. The engineer's participation with his habit of accurate thinking and precise analysis will be very beneficial.

At this crucial point, we, engineers, have a vital role to play in the development of the country. We are responsible for spending large sums of public money. Let us see that nothing is wasted and set an example to others by carrying out our duties conscientiously, diligently and selflessly.

A precarious situation has been created due to the unholy invasion by China of our country. We join our leaders with a firm determination to drive the aggressors and offer wholeheartedly our services to the country in this cause.'

ANNUAL REPORT OF THE COUNCIL FOR 1961-62*

The Council present to members the Annual Report for the year ended August 31, 1962.

1. Membership

1.1. *Members on the Roll*

The Roll of the Institution on August 31, 1962, stood at 36,210, with members and attached persons and bodies under different grades as below :

Honorary Members	Honorary Life Members	Members	Associate Members	Companions	Graduates	Students	Affiliates	Subscribers	Total
13	1	1,574	7,730	2	1,087	25,696	12	95	36,210

1.2. *Applications*

The position of applications for membership received and considered during the year under report was as follows :

Number of applications brought forward from the year 1960-61 ..	2,967
Fresh applications received during the year ..	11,709
	14,676
Balance at the end of the year awaiting disposal ..	4,458

1.3. *Year-Book 1960-61*

The second edition of the Year-Book of the Institution, corrected to August 31, 1961, was published in January 1962.

1.4. *Obituary*

The Council regret to record the deaths of the following members during the year :

Honorary Life Member

Sir Mokshagundam Visvesvaraya.

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* The Annual Report appears here in abridged form. Copies of the unabridged Report can be had on application from the Secretary.

Members

Homi Shapurji Batlivala, Gunendra Nath Chatterjee, Anil Chandra De, Muthuswami Gopalan, E. P. Grimsdick, U. N. Jha, Temuras Dorabji Kapadia, Tatapudi Narayana Rao, O. R. Narayanaswami Aiyar, D. Rajagopalan, Purushottam Vinayak Ranade, Taruvai Srinivasier Sankaran, Har Govind Trivedi, Lt.-Col. Stanislaus Edmund Cyril Vas.

Associate Members

R. K. Banerjee, Rajkumar Bakhshiram Bhatia, Bhabataran Chakrabarty, Hindpur Venugopal Rao, Tolaram K. Mirchandani, Raghunath Narhar Mohgaonkar, William Jayarayalu Paul Raju, Flt.-Lt. Duggirala Ramalingaswami, Awadha Behari Saran, Chimanlal Trikamlal Shah, Gopal Varadarajan, Heriyur Yesonath.

Student

S. N. Kulkarni.

1.5. *Expulsion*

The following members were expelled by the Council under the provisions of Bye-law 25 :

Associate Member

B. N. Kashyap.

Student

K. K. Kaul.

2. Finance and Accounts

2.1. The Statement of Accounts and the Balance Sheet duly audited by the Institution's Auditors for the year ended August 31, 1962, is given in Appendix I of the Annual Report (*not included here*).

2.2. During the year under report a number of donations were received (*details are given in the full Annual Report*).

2.3. *Public Charitable Trust for the Advancement of Engineering Education*

The following members were the Trustees of the Trust for the year : Maj.-Gen. Harkirat Singh, President, Dr. K. L. Rao, Shri D. P. R. Cassad, Shri S. B. Joshi and Dr. M. S. Thacker, Past-Presidents.

3. The Council

During the year under report the following ordinary Council meetings were held :

1.	Calcutta	.. September 9, 1961
2.	New Delhi	.. November 14, 1961
3.	Calcutta	.. February 4, 1962
4.	Bombay	.. May 20, 1962
5.	Calcutta	.. August 12, 1962

In addition, two special meetings of the Council under the provisions of Bye-law 25 were also held in Bombay on May 20, 1962.

4. Standing Committees of the Council

4.1. The Finance Committee of the Council as constituted at the 42nd Annual General Meeting was as follows :

The President

Andhra Pradesh
Dildar Husain

Assam
G. C. Goswami

Bengal
P. K. Ghosh

Bihar
K. N. Rohatgi

Bombay
N. K. Gandhi

Delhi
S. S. Kumar

Gujarat
U. N. Mahida

Jammu & Kashmir
P. N. Wanchoo

Kerala
C. S. Padmanabha Aiyar

Madhya Pradesh
Dr. V. M. Dokras

Madras
M. Ganapati

Mysore
R. A. Rajagopal

Nagpur
Y. K. Ghanekar

Orissa
S. S. Behera

Poona
Brig. P. R. Kumar

Punjab
D. C. Sharma

Rajasthan
K. N. Bhargava

Uttar Pradesh
K. N. Misra

4.2. The Applications Committee of the Council consisted of the following members :

The President

Andhra Pradesh
Brig. N. Sen Gupta
C. Seshavatharam

Assam
S. P. Chaudhury
M. R. Sitaram

Bengal
B. N. Bannerjee
B. N. Chaudhuri

Bihar
D. Mookerjea
G. S. Purohit

Bombay
R. N. Joshi
N. N. Purandare

Delhi
Dr. Shiv Narayan
Maj.-Gen. S. P. Vohra

Gujarat
G. S. Desai
M. M. Patel

Jammu & Kashmir
V. D. Zadoo

Kerala
S. Ramachandra
S. Varadaraja Sarma

Madhya Pradesh
Maj. L. R. Baronia
M. Y. Koli

Madras
Prof. P. Rajagopal Pillai
Prof. A. Srinivasan

Mysore
B. V. Patankar
C. N. Sharma Rao

Nagpur
H. G. Chaoji
K. S. Rama

Orissa
P. M. Menon
A. Shankaran

Poona
G. T. Gokhale
Dr. N. S. Nandeeswaraiya

Punjab
R. N. Chona
G. C. Khanna

Rajasthan
K. N. Bhargava
T. M. Desai

Uttar Pradesh
B. D. Goyal
S. P. Sinha

4.3. The Examinations Committee of the Council consisted of the following members : The President, Sarvashri K. C. Banerjee, Dildar Husain and V. G. Garde, Prof. N. S. Govinda Rao, and Brig. P. R. Kumar.

4.4. *General Purposes Committee*

The General Purposes Committee was dissolved by the Council at their 420th meeting of February 4, 1962.

4.5. *Engineering Science and Research Committee*

The Committee consisted of the following members :

Prof. N. S. Govinda Rao (*Convenor*), Dr. A. K. Chatterjee, Dr. M. N. Dastur, Prof. M. V. Deshpande, Dr. V. M. Dokras, T. R. Gupta, R. N. Joshi, R. S. Mehta, V. Y. Kamat, S. Varadaraja Sarma, Lt.-Gen. Sir Harold Williams, S. R. Mehra, S. Swaymbu, Maj.-Gen. S. P. Vohra, E. A. Nadirshah, Dr. K. L. Rao, K. F. Antia, and B. R. Subramanyam (*Secretary*).

4.6. *Committee for Advancement of Engineering Education*

The Committee consisted of the following members :

Dr. T. Sen (Convenor), Dr. A. K. Chatterjee, Dr. M. N. Dastur, Prof. M. V. Deshpande, Dr. V. M. Dokras, Prof. N. S. Govida Rao, T. R. Gupta, R. N. Joshi, R. S. Mehta, S. S. Kumar, N. N. Purandare, Prof. H. N. Ramachandra Rao, Prof. N. N. Sen Gupta, K. C. Banerjee, J. Datt, T. A. Desai, and B. R. Subramanyam (*Secretary*).

4.7. *Flood Control Committee*

The Committee consisted of the following members :

Dildar Husain (*Convenor*), P. R. Ahuja, R. D. Dhir, Prof. N. S. Govinda Rao, P. R. Guha, C. L. Handa, D. V. Joglekar, B. P. Kapadia, G. A. Narasimha Rao, S. Varadaraja Sarma, C. Seshavatharam, H. L. Uppal, S. Sarwal (*Secretary*).

5. Revision of Bye-Laws

The revised Bye-laws which were passed by a Special Meeting of the General Body of Corporate Members at Jaipur on November 26, 1960, were brought into force by the Council at their 426th meeting held in Calcutta on August 12, 1962.*

These Bye-laws had been submitted in December 1960 to the Government of India for approval by the appropriate authority. After some correspondence had been exchanged with the Government, the Ministry of Scientific Research and Cultural Affairs informed, in a letter dated May 7, 1962, that the Ministry of Law concurred with the opinion previously expressed by the Attorney-General of India that after the passing of the Constitution of India there was no authority in India which could take the place of the Privy Council for the purpose of granting the approval required by the Royal Charter for amendment of the Bye-laws of the Institution. The letter added that such absence did not prevent the Institution from amending its Bye-laws, and such amendments if made in accordance with its own rules were valid and binding as if they had been approved by the Privy Council.

As a consequence of the revision of Bye-laws, the Regulations of the Council have to be revised also.

5.1. Code of Ethics

The Code of Ethics for Corporate Members which has been current from 15th October, 1954, was revised during the year, and a new Code was adopted by the Council at their 426th Meeting held in Calcutta on August 13, 1962.

6. Local Centres and Sub-Centres

The last Local Centre of the Institution established in Gujarat in 1960-61 completed the coverage of all the States of the Indian Union.

During the year, a new Sub-Centre was established at Dhanbad.

7. The *Journal* and the *Bulletin*

7.1. *The year's publications*

The publications policy of the Institution was revised in June 1961, and as a result the *Journal* was divided into seven Parts corresponding to the Divisions of the Institution. These were : Civil Engineering Division; Mechanical Engineering Division; Electrical Engineering Division ; Electronics and Telecommunication Engineering Division ; Chemical Engineering Division ; Mining and Metallurgy Division ; and General Engineering Division. The *Journal* Parts were regularly issued under this scheme during the year.

The *Bulletin* was published each month as heretofore.

7.2. *Technical Papers*

The number of technical papers and articles published under the various Divisions and Groups in the *Journal* during the year were : Civil Engineering Division 35, Mechanical Engineering Division 19, Electrical Engineering Division 25, Electronics and Telecommunication Engineering Division 16, Chemical Engineering Division 5, Mining and Metallurgy Division 6, General Engineering Division 12, Public Health Engineering Group 8, Structures Group 1, and Roads and Road Transportation Group 4; and in the *Bulletin*, 13 articles were published in the same period, making a total of 144. Besides these, 7 articles on Contemporary World Projects and 10 discussions on papers were also published.

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*These Bye-laws have since been restrained by a Court injunction from being put into effect.

The number of papers received during the year was 171. Out of these, 107 were approved for publication, and 16 were awaiting the recommendations of the Sectional Chairmen.

7.3. *Hindi Section*

The Hindi Section continued to be guided by Shri Brijmohan Lal, Adviser. Under the new scheme of publications, its *Journal* but was issued in December 1961 and August 1962. The issue for April 1962 was not published. The first issue contained 9 articles and the second 13 articles, making a total of 22.

The publication of the Hindi Section *Journal* but as a separate volume has appreciably improved the standard of the articles.

7.4. *Museum of Indigenous Technical Literature*

More books have been added to the Museum during the year. The Museum is under the charge of the Nagpur Centre and works under the guidance of Shri Brijmohan Lal, Adviser, Hindi Section.

8. **Examinations**

8.1. *Results of examinations held in November* 1961 *and May* 1962

The results of the Institution examinations held in November 1961 and May 1962 were as follows:

Studentship Examination

	November 1961	May 1962
No. of candidates appeared	676	927
No of candidates passed	58	103
Percentage passed	8.57	11.11

Section A

	November 1961	May 1962
No. of candidates appeared	5,357	6,906
No. of candidates passed	294	453
Percentage passed	5.48	6.54

Section B

	November 1961	May 1962
No. of candidates appeared	1,182	1,673
No. of candidates passed	182	343
Percentage passed	15.38	20.5

Section C

No. of candidates appeared	23
No. of candidates passed	19
Percentage passed	82.6

8.2. *Regrouping of Subjects in Sections A and B of the Associate Membership Examination*

The draft syllabuses in the proposed new scheme of regrouping the subjects in Sections A and B of the Associate Membership Examination were finally adopted by the Council with certain modifications at their 420th Meeting dated 9th September, 1961.

The procedure for introducing the new scheme of examinations was also established, the rules revised and printed with the syllabuses in a new booklet. The examinations in the new scheme will be held for the first time in November 1962.

9. **Recognition of Exempting Qualifications**

(a) The following qualifications were recognized as exempting from the Studentship Examination of the Institution :

(1) Diplomas in (i) Civil, (ii) Mechanical, (iii) Electrical, (iv) Public Health, and (v) Architecture and Town Planning of the Jabalpur University.

(2) (i) Radar Mechanics, and (ii) Wireless Operator Mechanics (Group I) Conversion Courses of the No. 3 Ground Training School, Air Force Station, Jalahalli, Bangalore.

(3) Diploma in Automobile Engineering of the University of Kerala.

(4) Diploma in Automobile Engineering of the State Board of Technical Education, Kerala.

(5) Dip. Tec., Diploma in Electrical Technology awarded by the Department of Technical Education, Maharashtra.

(6) Draftsman Diploma in (i) Civil, and (ii) Mechanical Engineering of the Ramgarhia Polytechnic, Phagwara.

(7) Licentiate Diploma in Mining Engineering of the State Council for Engineering and Technical Education, West Bengal.

(8) Overseer's Diploma in (i) Electrical, and (ii) Mechanical Engineering of the Ad-hoc Board of Engineering Education, Uttar Pradesh.

(9) Diploma Course (now defunct) in (i) Civil, and (ii) Mechanical and Electrical Engineering conducted by the Director of Education, Madhya Pradesh, Gwalior.

(b) The following qualification was recognized as exempting from Section A of the Associate Membership Examination of the Institution :

Diploma in Mechanical Engineering from the Jamshedpur Technical Institute.*

(c) The following qualification was recognized as exempting from Sections A and B of the Associate Membership Examination of the Institution.

M.Sc. (Tech.) Degree in Electronics of the Rajasthan University, Jaipur, with the proviso that candidates qualifying for the M.Sc.(Tech.) Degree in Electronics must have passed in the paper on 'Drawing and Design of Electrical and Electronics Equipment and Apparatus.'

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* Students who obtained the Diploma prior to 1962 will be exempted from Section A provided they pass an examination in 'Advanced Physics' and are duly certified to this effect by the Superintendent of Training, Jamshedpur, Technical Institute.

10. Annual General Meeting

The 42nd Annual General Meeting was held in Bombay between February 1-8, 1962.

A full account of the 42nd Annual Session has been published on pages 9-24 of the Bulletin, vol. 11, no. 7, March 1962.

11. Representation on other bodies

The names of the representatives of the Institution on other bodies are given in Appendix II of the Annual Report (*not included here*).

12. International Conferences

Sixth Plenary Meeting of the World Power Conference, Melbourne, Australia, October 20-26, 1962.

The Sixth Plenary Meeting of the World Power Conference will be held in Melbourne, Australia, between October 20 and 26, 1962. The theme of the Meeting will be 'The Changing Pattern of Power'.

The Institution in its capacity as the Indian National Committee for the World Power Conference submitted the following papers for the Meeting:

(1) 'Hydro-electric Resources of India' by K. P. S. Nair (*M.*)

(2) 'Progress of A.C. 25 kV Single-Phase Electric Traction in India' by H. D. Awasty

(3) 'Some Economic Aspects of Nuclear Power in India' by Dr. H. J. Bhabha (*Hon.M.*) and M. Dayal

(4) 'Co-ordination of Different Types of Electrical Power Stations' by Prof. M. V. Deshpande (*M.*)

A delegation was selected by the Indian National Committee and submitted to the Government of India. The Government accepted two names out of the delegation and added one more. The personnel of the delegation which proceeded to the Meeting were: Prof. M. V. Deshpande (*M.*) (Leader), Chairman, Electrical Engineering Division, Shri S. Swayambu (*M.*), and Shri M. Dayal (*Non-member*).

Sixth World Petroleum Congress, Frankfurt, German Federal Republic, June 19-26, 1963.

The Sixth World Petroleum Congress will be held in Frankfurt, German Federal Republic, between June 19 and 26, 1963.

The Institution in its capacity as the Indian National Committee for the World Petroleum Congress has been allotted a quota of one paper. The following paper will be forwarded shortly: 'Exploration and Development for Oil in India' by L. P. Mathur and G. Kohli of the Oil and Natural Gas Commission, Government of India.

The Institution has also been requested to nominate a Vice-Chairman for the Technical Session on 'Geophysics and Geology'. This is receiving consideration.

13. Paper Meetings at Local Centres, Visits and Excursions

Details are given in Appendix III of the full Annual Report.

14. The Council wish to thank the many honorary workers for their very valuable service rendered during the year and to record that they are deeply conscious of their

contribution. In particular, the Standing Committees of the Council, the Committees of the Local Centres, and Shri Brijmohan Lal, Adviser, Hindi Section, deserve mention. The Council also acknowledge with appreciation the great volume of work conducted by the staff of the Headquarters and the Local Centre offices.

Summaries of Papers Published in the Journal, vol. 43, no. 6, pts. EL 3 & CH 2, February 1963

ELECTRICAL ENGINEERING DIVISION

Application of Monte Carlo Method for Analysis of D. C. Electric Network

Dr. S. Das Gupta
Non-member

A means of solving a D.C. network employing the Monte Carlo method is developed. It is described in such a manner that the method could be used directly for programming a digital computer. A circuit is taken up as an example and its conductance matrix (loop) is obtained from its loop resistance matrix by this method, and it is compared with the actual values (correct to four places of decimals). The solution is sampled at an interval of ten games to compare with the actual result for an investigation as to the convergence of the solution. A method (Newton's approximation formula) is applied to improve upon the accuracy. Finally, the advantages and disadvantages of the method are discussed.

Linear Graph Theory—a Growing Engineering Discipline

P. S. Satsangi
Non-member

This paper deals with some aspects of the linear graph theory such as (i) definition of topology; (ii) its applications to engineering problems; (iii) basic definitions; (iv) abstract theorems; (v) matrices of graphs and their interrelations for oriented as well as non-oriented graphs; (vi) properties of incidence, seg and circuit matrices; (vii) methods of approach for proving results; (viii) introduction of variables; and (ix) formulation procedures of system equations inherent in the linear graph theory. The paper illustrates the orderly procedure to be followed by an example.

Power Supply in Steel Plants

S. W. Tewari
Non-member

Steel production is directly related to the country's power generation capacity. With increase in the production in steel, the installed power generation capacity has also to increase. The percentage increase in the production of steel ingot between the period 1950-51 and 1960-61 was 150% and the corresponding increase in the installed capacity of the generating plant was 147.3%. The most important aspects of the power supply system of a steel plant are: service reliability, flexibility, safety, economy, correct voltage for distribution, and good voltage regulation. Some of the salient features of the main receiving station and the plant power house of a modern steel plant are explained in the paper.

CHEMICAL ENGINEERING DIVISION

Evaluation of Domestic Fuel Situation in India and Some Practical Measures to Meet It

E. G. K. Rao

Associate Member

Domestic fuel in India will perhaps remain a major problem for a long time to come. As such, conservation of the various fuel resources and their economical and balanced exploitation would be of great interest to the nation. The urban consumption of fuel is of the order of 20 million tons of coal equivalent (Mtce) and the rural consumption figure is 77 Mtce. There is enormous wastage of cowdung through burning since it kills its legitimate function of being used as a manure and thus deprives the country a production of nearly 9 million tons of food every year. The utility of the dung as a fuel, it is brought out, can be increased and its manurial quality considerably upgraded by fermenting the raw dung in a bio-gas plant. The economics of the process is worked out. The usage of methane as an engine fuel is indicated, as also the establishment of community wood lots as a step to save the soil from erosion through erratic deforestation for obtaining fire-wood. The economic implication of production of charcoal from wood is examined and it is pointed out that the indigenous all-loss method of preparation of charcoal by burning with limited air supply in heaps is uneconomical and should be replaced as far as possible by destructive distillation in closed retorts, with the fullest possible recovery of byproducts of economic value. Briquetted smokeless fuels from materials like charcoal and coal slack and screenings are suggested as a method of utilizing materials now wasted.

Corrosion of Metals, Manufactured Articles and Equipment—1: Industrial Corrosion

(Shrimati) **T. S. Shaha**

It is well known that corrosion means wearing away of metal from the surface inwards. Corrosion consists essentially of reaction between the metal and the environment to which the metal is exposed and is therefore the result of both these factors. The paper makes a study of these factors to evaluate a way of controlling corrosion as there is no universal test for this purpose. The paper illustrates the several aspects of corrosion by means of graphical relationships and deals with the subject of corrosion in two parts, the first of which appears here.

INSTITUTION NOTICES

Refund of Examination Fees for the November 1962 Examinations

Examination fees once paid are neither refundable nor transferable to any subsequent examination or to any other account. This is specified in rule 30 of the Rules of Examinations. In the case of examinations held in November 1962, it was found that a certain number of candidates were prevented from appearing in the examinations due to the exigency of the National Emergency. Some of them wrote to the Secretary requesting consideration of their case.

The Council have now decided to leave the disposal of these cases to the discretion of the Secretary. Accordingly, the Secretary now notifies that those candidates who submitted their examination forms for the November 1962 examinations and remitted the necessary fees, but were subsequently prevented from appearing in them through service exigencies resulting from the National Service may apply to him for consideration of refund of fees. Each such application must be accompanied by documentary evidence that it was solely on account of emergency service requirements that the candidate could not sit in the examinations. The Secretary may call for any additional evidence he may consider necessary. His decision will be final. Otherwise rule 30 of the Rules of Examinations will apply.

Interval between Interviews by Referees

The Council have approved a recommendation made by the Examinations Committee that the interval between two interviews for candidates appearing in the Section B Examination for the first time may be reduced from four months, *vide* rule 17(d) of the Rules of Examinations, to two months. This decision is effective from February 17, 1963, and was publicly notified towards the end of February 1963 for the benefit of those candidates who might be able to take advantage of it for the May 1963 examinations.

This does not have retrospective effect. All that it means is, that in future candidates may take the second interview two months after they have taken successfully the first, and the second interview two months after they have successfully taken the second.

INSTITUTION NEWS

Misdemeanour in Institution Examinations

The Council have decided to cancel the results of the following candidates for the November 1962 examinations and debar them from appearing in the three immediately following examinations, *i.e.*, up to and including May 1964, for misdemeanour in the aforesaid examinations.

Studentship No.	Roll No.	Name
S. 25936	3612A	Madan Sain Singhal
34697-S	St.-840	Ashwani Kumar Mangatala

The Council also decided to cancel the results of the following candidates for the November 1962 examinations and debar them from appearing in the four immediately following examinations, *i.e.*, up to and including November 1964, for misdemeanour in the aforesaid examinations.

Studentship No.	Roll No.	Name
S. 25536	3118A	Harbans Singh
S. 38885	6158A	Umrao Singh Sidhu

FORTHCOMING CONFERENCES

International Conference and Exhibit on Aerospace Support, Washington, August 4-9, 1963

As announced in the *Bulletin* dated October 1962, the International Conference and Exhibit on Aerospace Support will be held in Washington from August 4 to 9, 1963. Over 200 technical papers will be presented at the Conference. These will be pre-printed, bound and distributed to all registrants. Representatives from industry and Government will take part in the panel discussions and many companies engaged in the manufacture of support equipment have reserved space for their exhibits. Defence agencies are also planning outstanding exhibits of materials, plans and processes relating to support.

Further details of this Conference can be had from the International Conference and Exhibit, Box 6635, Washington 9, D.C., U.S.A.

International Exhibition of Industrial Electronics, Basle, September 2-7, 1963

The International Exhibition of Industrial Electronics will be held in Basle, Switzerland, from September 2-7, 1963. The guiding idea is to provide the exhibitors of electronic components and appliances with an opportunity to demonstrate what they have to offer to industry as well as to potential buyers from many countries with a view to opening up business connections throughout the world.

The exhibition will take place simultaneously with the Congress of the International Federation of Automatic Control which will also take place in the halls of the Swiss Industries Fair between August 27 and September 4, 1963.

Further details of the Exhibition can be had from INEL 63, Exhibition Management, Swiss Industries Fair, Basle 21, Switzerland.

Symposium on 'Automatic Production in Electrical and Electronic Engineering', London, October 24-25, 1963

The Institution of Electrical Engineers will hold a two-day Symposium on 'Automatic Production in Electrical and Electronic Engineering' in October 1963. The subjects proposed for the Symposium are :

1. Design of components for automatic assembly
2. Automatic functional testing of electrical components and assemblies

3. Automatic production processes
4. Automatic assembly
5. Automatic inspection and testing
6. Automatic adjustment
7. Automatic production scheduling
8. Automatic storage and distribution.

Members who desire to contribute papers, which should be between 1,000 to 1,500 words in length, are invited to send the suggested title and an outline of the paper not exceeding 200 words to the Secretary, The Institution of Electrical Engineers, Savoy Place, London, W.C. 2, not later than March 31, 1963.

Second International Conference on Water Pollution Research, Kyoto, Japan, August 1964

The Second International Conference on Water Pollution Research will be held at Kyoto, Japan, in August 1964, under the chairmanship of Prof. W. W. Eckenfelder, Department of Civil Engineering, Manhatten College, New York, and is supported by the U.S. Public Health Services and the World Health Organization.

The aims and objectives of this Conference are:

(i) To provide a forum where reports on outstanding research in water pollution from all parts of the world may be presented and to provide a medium for the publication of such reports;

(ii) To provide an opportunity for scientists engaged in water pollution research to meet and discuss matters of common interest;

(iii) To stimulate cooperation among nations in the conduct of research by identifying significant research needs of common interest;

(iv) To encourage newly developing nations to participate in the conduct of research on water pollution problems; and

(v) To promote international goodwill by providing scientists from many nations an opportunity to pool their research experience and knowledge in the solution of water pollution problems.

A permanent Steering Committee of the Conference has been established under the Secretaryship of Mr. B. Berger, United States Public Health Services, Washington. A National Committee for India is being formed with Shri R. S. Mehta (*M.*), Chairman, Public Health Engineering Group, Director, Central Public Health Engineering Research Institute, Nagpur, as Convener. Members desiring to present papers in this Conference may send two copies of abstract of the paper to the Director, Central Public Health Research Institute, Nagpur, before April 30, 1963. The complete paper should be sent to him not later than November 30, 1963.

Further details of the Conference can be had from the Director, Central Public Health Research Institute, Nagpur.

Fourth International Congress on Surface Active Agents, Brussels, September 7-12, 1964

The European National Committees of the Comite International de la Detergence (C.I.D.) will organize the Fourth International Congress of Surface Active Agents from September 4-7, 1964, in Brussels. This Congress will deal with the latest developments in the fields of research and application of surface active substances. The programme of the Congress will be divided into four Sections corresponding to the general themes : Section A—Chemistry of the Surface Active substances ; Section B—Physics of Interfaces ; Section C—Terminology, Analysis, Testing Methods and Waste Waters ; and Section D—Application of Surfactants. The Congress will be held in three languages, *viz.*, French, English and German.

Further details of the Congress can be obtained from the General Secretariat of the Fourth International Congress of Surface Active Agents, 49 Square Marie-Louise, Brussels 4, Belgium.

14th Sectional Meeting of the World Power Conference, Lausanne, September 13-17, 1964

The 14th Sectional Meeting of the World Power Conference will be held in Lausanne, Switzerland, from September 13-17, 1964. The theme of the Conference is 'The Struggle Against Losses in the Field of Energy Economics'. The general theme is divided into four Divisions and each of these Divisions is again divided to suit the natural breakdown of the subject as below.

1. General aspects
    - (A) Extent and limits of the reduction of losses
    - (B) Sources of losses due to protective measures taken to avoid damages arising from energy conversion
2. Avoidance of losses in conversion
    - (A) Water power stations
    - (B) Thermal power stations
    - (C) Present tendencies for improving the efficiency of nuclear stations
    - (D) Reduction of energy losses in fuel conversion
    - (E) Improved energy-efficiency in plants for the direct conversion of energy
3. Avoidance of losses in fuel transport and power transmission
4. Avoidance of losses in utilization of energy
    - (A) Industry
    - (B) Space heating, air-conditioning and water heating

The Institution of Engineers (India) continues to act as the Indian National Committee of the World Power Conference. Further details of the Conference can be obtained from the Head Office of the Institution.

BOOK ACKNOWLEDGMENTS

1. **The Application of Digital Computers to Structural Engineering Problems.** D. M. Brotton. *E. & F. N. Spon Ltd.*, 57s. 6d. 183 pages.

This book deals with the description of electronic digital computers, programming and coding for them, and numerical analysis, and gives examples in the field of structural engineering of their use. This is meant to give the engineer possessing the minimum academic qualification and students of structural engineering an introduction to the capabilities of these machines in connection with design calculations.

2. **Practical Handbook for Sanitary Engineers.** M. N. Chinoy. *Published by the author, 24 Tata Block, Turner Road, Bombay 50.* Rs. 10. 131 pages.

This practical treatise embodies modern practices in sanitary engineering, and is designed to be useful to students specially and to sanitary and public health engineers in general.

3. **The Design and Placing of High Quality Concrete.** D. A. Stewart. *E. & F. N. Spon Limited*, 50s. 2nd edition. 162 pages.

This book covers a review of the early practice in concreting and the development of theories relating to the behaviour of the material and their effect on practice. It then gives a detailed study of the characteristics of concrete and an analysis of the factors governing the making and placing of high quality concrete. The book is meant to serve not only the student but the practising engineer also. This edition of the book has been revised in the light of a large volume of technical data available since 1951, and also, the various anomalies which seem to have arisen in practice have been explained.

4. **Practical Introduction to Microbiology.** E. M. Linday. *E. & F. N. Spon Ltd.*, 45s. 227 pages.

This book is written for the use of biochemical engineers, chemical engineers, municipal engineers, chemists in the pharmaceutical industry, and to others who may or may not have a biological training but nevertheless come up against microbes in their work.

5. **Introduction to Gas Dynamics.** R. M. Rotty. *John Wiley & Sons, Inc.*, $ 8.75. 272 pages.

This book is designed to provide the student and the practicing engineer with a review of the fundamentals of thermodynamics and fluid mechanics and their modern applications. The principles discussed are tied to the solutions of particular problems encountered in the respective fields.

6. **Conveying Ideas.** H. Compton. *Cleaver-Hume Press Ltd.*, 15s. 157 pages.

This book attempts to offer guidance in the craft of writing to professional men such as business men, administrators, scientists, technologists and students, who have to write from time to time in the pursuit of their callings.

LIST OF NEW ELECTIONS AND TRANSFERS

(*Continued from Bulletin for January 1965*)

STUDENTS

No.	Name
34641	Sankaradeekshidar Sundararaman
34642	Madathil Narayanan Damodaran Plappally
34643	Thimiri Govindaswamy Krishnamoorthy
34644	Mahendra Pal Sikka
34645	Santhanam Srinivasan
34646	Gopal-Mudaliar Venkatesan
34647	Subramaniaiyer Rajagopal
34648	Ramamoorthy Srinivasan
34649	Gangaian Perumal
34650	Viswanathan Lakshminarayanan
34651	T. Ellappan Subbarayan
34652	Venkataraman Sankara Krishnan
34653	Varadaiyengar Govindarajan
34654	Ramamoorthi Nagarajan
34655	Krishnapanicker Rama Panicker
34656	Thangavelupillai Shanmugam
34657	V. Vasudevarao Srinivasan
34658	Govindarajalu Harinath
34659	S. Chandrasekara Trivedi
34660	S. Radhakrishnan
34661	Rajagopala Chella Sundaram
34662	Dinakaran Asirvadham
34663	Thirumalai Parthasarathy
34664	Valady Venkatrama Ganesan
34665	S. V. Bakthavatchaalan
34666	Subramaniam Kalyanasundaram
34667	Kalimuthu Subbarayan
34668	Subbarayan Srinivasan
34669	C. Venkatachalu
34670	R. Janakiraman
34671	Chembolli Ravindranathan
34672	Krishnaswamy Easwaran Chetty
34673	Subramaniam Nanjundan
34674	Jyotindra Nath Jena
34675	Sahadeb Meher
34676	S. Munisamy Loganathan
34677	Sitaramarao Ranga Mani
34678	T. Nagaraja Balasubramanian
34679	Kitchi Srinivasan
34680	Koduru Sarat Babuji
34681	G. Janaki Ramiah Chetty
34682	Jayadeb Meher
34683	Satish Jashubhai Patel
34684	Yellevanaicker Subbarayalu
34685	Kizhackedathu Chacko Kurien
34686	Nemakal Sridhara
34687	Satturu Venkata Rao
34688	P. Arumugam
34689	P. Joseph Thomas
34690	K. Rappai David
34691	P. Konaprasad
34692	Makkapati Sivaram Prasad
34693	Veera Raghava Reddy
34694	James Edward Daniels
34695	R. Balasubramanian
34696	Sayed Mahammed
34697	Janaswami Sriramachandra Murty
34698	M. Shanmugam
34699	Ramachandran Bhanu
34700	D. Veeraraghavan
34701	Sethurao Narasimha Murthy
34702	Srinivasan Raghavachari
34703	Abdul Gafoor Abdul Aziz
34704	Seetala Narayana Rao
34705	K. V. Venkateswaran
34706	N. Panlraj
34707	Ramachandran Rajaram
34708	R. R. Rajagopalan
34709	S. Radhakrishnan
34710	K. Venkateswaran
34711	A. Radhakrishnamurthy
34712	J. Balusamy
34713	Veeraputran Ganesan
34714	T. S. Kaliyaperumal
34715	T. Narasinga Soundararajan
34716	Subbaraman Govindarajan
34717	Dharmapuri Vacharpathy Narayana
34718	Vaidyanathan
34719	G. Natarajan
34720	Guruswamy Balakrishnan
34721	Lutfar Rahaman Mallik
34722	Penmatsa Sahab Prasada Raju
34723	Kalaga Radha Gopala Krishnamurty
34724	Shreepad Bhimarao Kanchi

STUDENTS (*contd.*)

No.	Name	No.	Name
34725	Rangaswamy Rameswamy	34770	Cadambi Rangaswamy Seshadri
34726	Venkatasamy Sachithanandam	34771	Palur Venkata Santharam
34727	Behara Yerramraju	34772	Robendro Kumar Adhikari
34728	Budhi Jayaram	34773	T. Ittoop Verghese
34729	Gajula Pedda Narayana	34774	Tara Chand Bansal
34730	R. Venkata Chalapati Rao	34775	Satya Prakash Khatri
34731	Bodicherla Bhimeswara Rao	34776	Raghavan Vasu
34732	M. K. Aravindakshan Nair	34777	C. L. Venkatavaradan
34733	Desigan Govindan	34778	U. Sridharamoorthy Accharya
34734	V. Subramanian Kapali	34779	S. Narasimhan
34735	Kasiviswanathan Venkatachalam	34780	Putthur Narayanan Gopal
34736	P. S. Ramakrishnan	34781	Gokul Chandra Pradhan
34737	A. Savarimuthu	34782	N. Venkatesan
34738	Vaidyanathan Srinivasamurthy	34783	K. Mukhyaprana
34739	Alexis Pereira	34784	N. S. Velayuthan
34740	Hosur Katti Ramachar	34785	Bhupendra Nath Bhattacharyya
34741	Thirumurthy Subbaramakrishnan	34786	A. Srinivasaramanujam
34742	K. P. Radhakrishnan Nair	34787	Varghese Jacob
34743	Bimal Kanti Bose	34788	Jayanti Uma Sankaram
34744	N. A. Venkatasubramanian	34789	Subramaniam Swaminathan
34745	Jagjit Singh	34790	Alandur Jayachandran Raman
34746	Eswarahalli Rangaswamy Seshadri	34791	Joseph C. Chacko
34747	V. Sankarakrishna Sarma	34792	M. Dorairaj
34748	Balasundaram Srinivasan	34793	Velloli Damodaran
34749	V. Hariharan	34794	K. Chandrasekharan Nayar
34750	Mantha Venkata Krishna	34795	Arunachalam Arumugam
34751	Mudumbi Kasi Ramamurthi	34796	M. B. Santhamurthy
34752	Duraiswamy Bhuvaneswaran	34797	P. Eswaramoorthy
34753	Chulliparambil Kumaran Dasan	34798	Thottekat Aravindhakshan
34754	C. Sarangarajan Srinivasan	34799	P. S. Arunachalam
34755	Benoy Kumar Mukherjee	34800	S. Muthukumaraswamy
34756	Chetty Govindaswamy Naidu Kothandar	34801	Velayudhamudaliar Govindaraj
34757	Ramaswami Sethuraman	34802	Karuppanna Dorairaj
34758	G. Chandrasekaran	34803	Subbayya Muthukrishnan
34759	Srinivasarao Venkataraman	34804	D. Satyadev Mothiram
34760	Ramachandra Bhat	34805	S. Narayana Raja
34761	Belur Kirshnaswami Balaram	34806	Kapiath Elambilari Raghavan
34762	Bhumi Dhar Das	34807	Ramamurthy Sridharan
34763	Shyam Sunder Batra	34808	Natesa Palani
34764	Krishnagiri Lingappa Ramamurthy	34809	T. Sundararaman Narayanan
34765	B. C. Sathyanarayan	34810	Rameswamy Narayanan
34766	Kailash Chandra Dehuri	34811	P. Govindasami Janardhanan
34767	Lakshmi Kanta Pattanaik	34812	Jagannathan Venkatesan
34768	Premchand Das Patnaik	34813	Arjuna Pillai Pitchamani
34769	Venkataraman Seshadri	34814	Ramaiyer Ganesan

STUDENTS (*contd.*)

No.	Name
34815	Ramachandraiyer Mahalingam
34816	Ramasadagopan Vijaya Raghavan
34817	T. M. Chakravarthi Narasimhan
34818	Subramania Raghuraman
34819	N. Malayalam
34820	Yerra Ekambareswara Rao
34821	Sivaramasundaram Muthiah
34822	Sivaswami Viswanathan
34823	Arani Balasubramaniam Raman
34824	Swaminathaiyer Balan
34825	S. Jagannatha Venkatarangan
34826	Natarajan Srinivasan
34827	Srinivasa Sourirajan
34828	Narayanan Subbiah
34829	Nithyanathan Ramalingam
34830	Parthasarathy Krishnaswamy
34831	Krishnasamy Srinivasan Krishnasamy
34832	Ramabadra Devanathan
34833	Srinivasan Raghunathan
34834	Karumbalur Arunachalam Sellamuthu
34835	Ganapathy Jayaraman
34836	Ganapathy Subramanian
34837	Asuri Krishnaswamy Sreenivasan
34838	Amirthalingam Srinivasan
34839	Chollappanpillai Raman Pillai
34840	Thumhbavanam Rajagopala Balakrishnan
34841	B. Mathiprakasam
34842	Ganti Srinivasa Rao
34843	G. Atchuta Rama Raju
34844	Raghavachari Sundararajan
34845	V. Ethirajalu
34846	Baghyanathan Lourduswamy
34847	Echur Krishnaswamy Ranganathan
34848	Thovangudi Rajagopal Ramadurai
34849	Pullabhatla Bharadwaj
34850	Elamthottam Korah Jose
34851	Manne Yedunanda Prasada Rao
34852	K. Padmasundaram Ramanathan
34853	Bollapalli Rajamohan
34854	Kadiyala Muni Krishnama Naidu
34855	Sarat Kumar Pati
34856	T. A. K. Ananthalwar
34857	Mirza Shoaib Baig
34858	S. Ramaswamy
34859	Cheeran Cherappai Charly

No.	Name
34860	P. Sreekumaran Thampy
34861	Rabindra Nath Rout
34862	S. Srinivasan
34863	T. S. Mahadevanayyar
34864	V. Krishnaswamy
34865	Balasubramanian Gurunathan
34866	T. R. Shanmugham
34867	A. S. Ganapathy
34868	Duraisami Muthuraman Narasimha Baskaran
34869	J. Aloysius Sounder Rajan
34870	Parthasarathy Shanmugam
34871	Chakravarthi Pattuswamy
34872	Handattu Shankar Nayak
34873	Ramaswamy Alagirisamy
34874	P. N. Viswanathan
34875	Raghavachari Lakshminarasimhan
34876	Srinivasan Ananthasubramanian
34877	K. A. Mathewkutty
34878	Duraiswamynaidu Bakthavatsalu
34879	Potluru Krishna Das
34880	Kunatharaju Krishnamurthi Raju
34881	Ramaswamy Rajagopalan
34882	Chinna Obulaputam Prakasam
34883	Shanmugam Ganesan
34884	Balasubramanian Srinivasan
34885	Krishnamachary Lakshminarasimhan
34886	Mulamoottil Mathai John
34887	B. R. M. Sundaram
34888	Kuruswaminaicker Ramasubbh
34889	Pattukotai Vaidyanathan Vasudevan
34890	Mohan Raj Kalliath
34891	Haleyangadi Srinivasa Durga Prasad
34892	Rajeswara Mahadevan
34893	R. Sankaran
34894	Mohammed Ataullah Sharief
34895	Kuppuswaminayagar Balasubramanian
34896	Modepalle Sreenivasulu
34897	Pratap Chandra Paul
34898	Sundararajan Lakshminarayanan
34899	Varadarajan Annadurai
34900	Kunnimadthillam Krishnan Nambudiri
34901	Maruvancheriparambath Mathew John
34902	Easwaran Ramaswamy
34903	Nasiruddin Makhdumhusen Tragar

STUDENTS (*contd.*)

No.	Name
34904	Congi Deenadhayalan Devarajan
34905	Manni Venkatesan
34906	Prabhakaran Alexander
34907	Thillaisthanam Sundaracharier Raman
34908	P. V. Gopalakrishnan
34909	Nagesan Srinivasan Karthikeyan
34910	Gopalachari Lakshminaryanan
34911	William Fernandes
34912	Tati Reddi Chinnama Reddy
34913	Sivasangu Jeyachandran
34914	Alampundi Sitaraman Viswanathan
34915	Varavoor Parasuramaiyer Ranganathan
34916	Ramasamychetti Rajasekar
34917	Penmatcha Suryanarayana Raju
34918	Kesarimangalam Sivaraman Krishnan
34919	Annamalai Thenappan
34920	Natesa Sirnivasan
34921	Krishnamoorthy Ramanathan
34922	Chakkaramiyengar Srinivasan.
34923	Dandapani Venkatasubru
34924	K. Venkataraman
34925	T. Vasudevan Bhattathiripad
34926	Ayyalasomayajula Chidananda Murty
34927	Suryanarayanaiyer Shamanna
34928	Ananthakrishna Achar
34929	S. Balaramasamy Chandra Sekaran
34930	Gopalachary Srinivasa Ratnam
34931	Uppuluri Venkata Sitapati Rao
34932	Soundararajan Santhanam
34933	Godithi Veeraraghavulu
34934	C. N. Asokapanicker
34935	Kambhampaty Radhakrishnamurti
34936	S. Vedantadesikan Veeraraghavan
34937	Thalakodi Madam Rajagopalan
34938	Tirumalachari Jagannathan Satyamurthi
34939	Veeraswamy Purushothaman
34940	Mahendra Prakash Garg
34941	Yash Paul Singh Bhalla
34942	Ishwar Chandra Adhikari
34943	Baldev Lal Pawa
34944	Ishwar Chand Tawani
34945	Ram Krishan Verma
34946	Girish Chandra Yadav
34947	Surendra Nath Bajpai
34948	Narain Dutt Sharma
34949	Shrimander Lal Jain
34950	Suraj Bhan
34951	Bhagwatilal Agrawal
34952	Krishan Singh
34953	Satendra Kumar Tyagi
34954	Jai Pal Singh
34955	Anand Kumar Syngle
34956	Balkar Singh
34957	Ram Richpal Gupta
34958	Radhey Shyam Sharma
34959	Baldev Raj Sharma
34960	Satish Chandra Sharma
34961	Brij Mohan
34962	Suresh Chandra Srivastava
34963	Balram Krishan Arora
34964	Kishori Lal Gupta
34965	Raj Kishore Gupta
34966	Arjan Teckchandani
34967	Rajindar Singh Mudhar
34968	Vinayak Shridhar Kulkarni
34969	Hari Bhushan Gupta
34970	Purushottam Rajaram Mande
34971	Gurbaksh Singh Bhatia
34972	Harish Chandra
34973	Sisir Kumar Roy
34974	Jagjot Singh Chawla
34975	Durga Prasad Srivastava
34976	Swayan Prakash
34977	Raghu Raj Sarup
34978	Sudama Prasad Yadav
34979	A. C. Ram Kripal Singh
34980	Md. Shafiq Seddiqi
34981	Virendra Pal Garg
34982	Kalyan Singh Padyar
34983	Shri Niwas Agarwal
34984	Vijay Kumar Mathur
34985	Gopal Ji Mehrotra
34986	Rameshwar Dutt
34987	Jagmohan Singh Jaspal
34988	Suresh Sadashiv Gokhale
34989	Naresh Chandra Saxena
34990	Mohan Lal Godhwani
34991	Devendra Singh
34992	Upesh Chandra Trivedi
34993	Gajpat Singh Jain

STUDENTS (*contd.*)

No.	Name
34994	Satish Chandra Jain
34995	Vishan Sarup Verma
34996	Shri Kishan Rawat
34997	Umesh Chandra Shukla
34998	Changali Padmanabhan Nair
34999	Anil Kumar Deva
35000	Soom Nath Raina
35001	Shri Gopal Ranga
35002	Nemichand Goyal
35003	Bhupinder Kumar Gupta
35004	Khushi Lal Uthra
35005	Surendra Rai
35006	Vinod Kumar Srivastava
35007	Sher Singh
35008	Vimal Chand Jain
35009	Kamal Singh Rana
35010	Mohammad Wajahat Husain
35011	Madan Mohan Lal Suri
35012	Lac Vasant Achyut Rao Samant
35013	A. C. Yeshwant Kashinathrao Datir
35014	Alalaghatta Hiriyannappa Devadas
35015	Ramchandra Ganpatrao Dhavale
35016	Ram Kripal Shukla
35017	Shyam Roop Chand Bhandari
35018	Padmakar Trimbak Marathe
35019	Jagdish Prasad Srivastava
35020	Ram Chandra Sahai Bisaria
35021	Perma Nand
35022	Suresh Chander
35023	Jagjiwan Kumar
35024	Ananda Pralhad Nadgauda
35025	Kasturi Lal
35026	Robert John Fernandez
35027	Mysore Srikantiah Gundu Rao
35028	Jethalal Ramanlal Shah
35029	Shiv Dass Gupta
35030	Jai Prakash Bansal
35031	Hardip Singh
35032	Vishwanath Vishnu Kulkarani
35033	Sasanka Sekhar Mukherjee
35034	Hari Sankar Dutta
35035	Swapan Kumar Thakur
35036	Bharat Lal
35037	Jitendra Kumar Jain
35038	Santimoy Banerjee
35039	Tapan Kumar Basu
35040	Kartik Chandra Debnath
35041	Sebabrata De
35042	Parimal Kumar Mukhopadhyay
35043	Clifford Bastian
35044	Govind Nagesh Khire
35045	Susthir Kumar Datta
35046	Dipak Kumar Sen Gupta
35047	Sudheer Narayanrao Kulkarni
35048	Md. Qasim Ali
35049	Sourendra Narayan Das Gupta
35050	Tapan Kumar Ray
35051	Ismail Athar Ibrahim Emady
35052	Chatur Bhuj
35053	Subash Chandar
35054	Shiv Dan Singh
35055	Indra Pal Gupta
35056	Ram Saran
35057	Man Mohan Lal Sareen
35058	Vasu Dev Mittal
35959	Shiv Saran Dass Gupta
35060	Wali Mohammad Zaroo
35061	Anandi Nath Banerjee
35062	Rama Subramanya Sarma Meduri
35063	Prem Nath Soni
35064	Anandi Narain J. Mathur
35065	Shenvi Hede Somnath Bhiku
35066	Nandalal Jayakisan Kasat
35067	Indra Narayan Kundu
35068	Chahey Ram
35069	Shri Krishen Gupta
35070	O. M. Prakash
35071	Ram Chandra Pandey
35072	Laxman Gagandas Balani
35073	Jugal Kishore Jhanwar
35074	Ram Prakash Maheshwari
35075	Dharam Pal Puri
35076	Suraj Bhan Rathee
35077	Onkar Prasad Kulshrestha
35078	Lokesh Mahadeorao Mothghare
35079	Bangalore Seetharamiah Nagaraj
35080	Bijoy Kumar Bhattacharjee
35081	Barun Chandra Niyogi
35082	Suprakas Chaudhuri
35083	Samir Kumar Mukherjee

STUDENTS (*contd.*)

No.	Name
35084	Bansibadan Saha
35085	Kantiprakash Mukhopadhayay
35086	Guruprosad Chattopadhyay
35087	Sukumar Datta
35088	Amiya Kumar Bandopadhya
35089	Dipak Kumar Roy
35090	Birendranath Chakraborty
35091	Manilal Sengupta
35092	Samir Kumar Goswami
35093	Bijaykumar Biswas
35094	Karan Singh
35095	R. H. Raja Rao
35096	Sat Vir Gupta
35097	A. Rama Iyer
35098	Satish Chander Maini
35099	Inder Kumar Duegan
35100	Bishnu Pada Rakshit
35101	C. Rameswamy Venkiteswaran
35102	Kappagantula Venkateswarulu
35103	Shreeram Narayan Deshpande
35104	Anano Swarup
35105	Mylavarapu Suryanarayana Murty
35106	Prem Narain
35107	Malvalli Subbarao Padmanabha Rao
35108	Rama Keshava Gupta
35109	Narsingh Rai
35110	Umesh Jashvantlal Kapadia
35111	S. Somasundaram
35112	Mukund Ramchandra Ambike
35113	Kheta Pachan Patel
35114	Nawin Chandra Tiwari
35115	Shivaputra Mahalingappa Banagar
35116	Mohan Anando Rao
35117	Bekal Vamanji Rao
35118	T. Vasudevan
35119	Mahesh Chand Gupta
35120	Daya Shankar Dubey
35121	Bhanwar Singh
35122	Doraswamy Ramaiah
35123	Chandra Shekhar Vinayakrao Bakshi
35124	Ramesh Suryakant Bandodkar
35125	Farrokh-Jalejar Pastakia
35126	Hemanta Kumar Chakravartty
35127	Yogendra Singh Sirohi
35128	Balwant Laxman Karve
35129	Ranjit Kumar De
35130	Kamal Bandhu Bandyopadhyay
35131	Ramesh Chandra Garg
35132	Nanda Dulal Roy
35133	Deb Ranjan Banerji
35134	Madhukar Jethalal Lodhavia
35135	Sudhakar Dhondo Kulkarni
35136	L. Sivaramakrishnan Waidyanathan
35137	Wempati Sundarabeshiamnaidu Krishna
35138	Suresh Purshottom Bapat
35139	Prem Narain Bhatnagar
35140	Killugudi Sambamoorthy Jayaraman
35141	Govind Mohn Sharma
35142	Arvind Vishnu Kathavate
35143	Gaur Gopal Chakraborti
35144	Ashok Kumar Totuka
35145	Goparaju Venkata Sundara Rao
35146	Shriniwas Balaji Juglekar
35147	Mohan Lal Tikoo
35148	Kanwal Jit Singh
35149	Rajat Kanti Bhattacharyya
35150	Prabhakar Shrikrishna Dand Wate
35151	Chakravarthi Soundararajan
35152	Arun Ramchandra Gadre
35153	Prem Prakash
35154	Shripad Ramchandra Shenolikar
35155	Satyendra Kumar Sharma
35156	Vinyak Pandurang Gokhale
35157	K. N. Srinivasa Rangan
35158	Ashokkumar Gopinath Sakhalkar
35159	G. Vishnudasan
35160	Satish Kumar Gupta
35161	Ramchandra Gururao Sidenur
35162	Vasanth Shibad
35163	Lydia Chellam Manoharan
35164	Mukund Balkrishna Pathak
35165	P. Chandrapilli Cherian
35166	Ellath Kuriyil Bhaskaran
35167	Sudhakar Ganesh Kulkarni
35168	Om Prakash Khandelwal
35169	Ajit Kumar Maji
35170	Bangalore Krishnaswamy Jayaram
35171	Bhaskar Vishnu Bodas
35172	Ramani Mohan Ghosh
35173	Samir Kumar Mukherjee

STUDENTS (*contd.*)

No.	Name	No.	Name
35174	Asish Kumar Sanyal	35219	Vijaykumar Shamrao Bhonsle
35175	Subhasyam Bandyopadhyay	35220	Rajendra Kumar
35176	Bibhash Dasgupta	35221	Madhusudan Waman Dabak
35177	Govinda Goswami	35222	Grama Kasturirangan Raman
35178	Adwaita Charan Dutta	35223	Chandrakant Dattatraya Amdekar
35179	Sailesh Chand Bhattacharya	35224	Anilkumar Vasantrao Ambedkar
35180	Sisir Kumar Ghosh	35225	M. Venkatesh
35181	Sakti Pada Chatterjee	35226	Sadanand Anant Kelkar
35182	Shibendra Kumar Bhattacharjee	35227	H. S. Rajamohan
35183	Ramesh Chandra Agarwal	35228	Kailash Singh Shrimal
35184	Bijaybhushan Bhattacharya	35229	Netaipada Dey
35185	Ajit Kumar Chakrabarti	35230	Abdul Ghani Abdul Aziz Ishampuri
35186	Kalyan Kumar Ganguly	35231	Nirupam Chakrabarti
35187	Amar Kanti Ray	35232	Sadhan Ghosh
35188	Amarendranath Dan	35233	Paritosh Kumar Gangopadhyay
35189	Krishnapada Ghose	35234	Pijush Kanti Majumder
35190	Pranabnarayan Chaudhuri	35235	Subal Kumar Ray
35191	Anil Chandra Gupta	35236	Ranjit Kumar Bandyopadhyay
35192	Susanta Kumar Sinha	35237	Chitrajit Kumar Sengupta
35193	Narayan Chandra Biswas	35238	Biswanath Roy
35194	Prabir Sen Gupta	35239	Mihir Kumar Ray
35195	Tarunkanti Ghoshal	35240	Suresh Lall
35196	Satyabrata Mukhopadhyay	35241	Sasanksekhar Dasgupta
35197	Amarendra Narayan Roy	35242	Puspalkumar Nag
35198	Sankar Nath Roy	35243	Shridhar Kumar Mukherjee
35199	Kanai Lal Gangopadhyay	35244	Sarit Sengupta
35200	Bhaskar Dasgupta	35245	Om Parkash Dhingra
35201	Baidya Nath Ghosh	35246	Ramakant Eknath Mulay
35202	Vivekananda Guha Roy	35247	Mukund Nagesh Joshi
35203	Dipomoy Sen	35248	Vijay Vinayak Patwardhan
35204	Kusal Kumar Das	35249	Shiva Nandan Shai Johri
35205	Rajendra Prasad Sharma	35250	Ramdas Dayaram Gate
35206	Chandulal Jamnadas Gajiwala	35251	Cpl. A. Ranganathan
35207	Abdul Aziz Khan	35252	Arun Gajanan Deshpande
35208	Neelkandannair Somasekharan Nair	35253	Jagdish Prasad Mehrotra
35209	Krishna Mohan Saxena	35254	Deobrat Sinha
35210	Vijay Ramchandra Deshmukh	35255	Avinash Vaman Harkare
35211	Aswathanarayana Setty	35156	Moreshwar Madhaorao Deshpande
35212	Madan Lal Suri	35257	Cpl. Satya Parkash Malik
35213	Ashokkumar Sakarchand Mehta	35258	Vijay Bahadur
35214	Madhukar Ramachandra Abhyankar	35259	Joginder Singh Kawatra
35215	Piara Singh	35260	Manik Lall Banerjee
35216	Sharadchandra Shankarrao Dawane	35261	Anil Bhalchandra Hajarnis
35217	Srigakula Kodanda Ramaprasad	35262	Vidyanand Shankar Kallianpur
35218	Samir Kumar Ghose	35263	Shahmal Dass Gupta

STUDENTS (*contd.*)

No.	Name	No.	Name
35264	Yogesh Chandra Prajapati	35309	Jagannathan Jayaraman
35265	Krishnandra Pal Gupta	35310	V. K. Sundara Raju
35266	Birendra Kumar Sharma	35311	Syed Shamim Ahmed Naqvi
35267	Hari Shankar Jha	35312	Satyendra Nath Sarcar
35268	Subash Chander Malhotra	35313	Rameshchandra Gunvantprasad Joshi
35269	Shabbir-Kalimuddin Wadhwanwala	35314	Chamakura Venkata Krishnarao
35270	Namdeo Pandurang Pore	35315	Tankasala Vittala Rao
35271	Bimanbehari Mondal	35316	Srinivasan Narayanan
35272	Hemendra Kumar Jain	35317	Ajjayya Andanayya Vastrad
35273	Hiremagalur Doresamiengar Srinidhi	35318	Sohan Lal Nathawat
35274	Komarla Amarnath	35319	Chandrashekhar Mahadeo Dabak
35275	Bangalore Krishnaswamy Srinivasa	35320	Sudhakar Ramchandra Munagekar
35276	Vrajlal Odhavji Siddhapura	35321	Monoj Kumar Chakraborty
35277	Ramdas Madhavrao Kamath	35322	Subhas Chandra Biswas
35278	Shib Das Banerjee	35323	Kothamur Shankranarayana Rao
35279	Krishnaji Narayanrao Kulkarni	35324	Puttamadaiah Puttamadaiah
35280	P. Vishnumoorthy Upadhya	35325	Vardhinedi Radhakrishna Murthy
35281	Chandrakant Dattatraya Samudra	35326	Surendra Lal
35282	Prabhat Kumar Aditya	35327	Arivind Bhagwant Patil
35283	Nirmal Kumar Basu	35328	T. Subramaniaiyer Rajaraman
35284	Kulbhushan Dev Sharma	35329	H. M. Abdul Khiyum
35285	Alfred Raymond D Sa	35330	Gyanendra Dutt Joshi
35286	Mohammad Ozair Ahmad	35331	Ram Jethanand Kanal
35287	Pravakar Ramchandra Munagekar	35332	Arvind Pratap
35288	Bhimaji Krishna Kulkarni	35333	Ved Prakash Dangwal
35289	B. S. Bhojaraju	35334	Cpl. Om Prakash Dixit
35290	Hodigere Seshagirirao Satyanarayana	35335	Sambhaji Krishnaji Roman
35291	Jagbir Singh	35336	Narayan Shankar Suratran
35292	Nallor Rajagopala Menon	35337	Shashikant Gangadhar Dharmadhikari
35293	D. Nachiketa	35338	Satya Raja Rao
35294	Umakant Joshi	35339	S. Pillappa Suryanarayana
35295	Bhagavant Anant Sukate	35340	Gona Victor Prabhakar
35296	Radhakrishnan Srinivasan	35341	Hassan Surasetty Prabhakar
35297	J. C. Mathew	35342	Bajirao Sakharam Patil
35298	Cpl. Mohan Singh	35343	Srinivasa Narayana Moorching
35299	Subashchandra Majumdar	35344	Ratilal Khushal Sonvane
35300	Kanwar Singh Yadav	35345	Bhalchandra Waman Pethe
35301	T. Mathew George	35346	Achanta Sridhara Rao
35302	Chandra Vali Mishra	35347	Prabhakar Vaman Erande
35303	Ratnakar Vishnu Vaidya	35348	Pritam Lal
35304	Niharranjan Chakraborti	35349	Kunnath Ayyappan Prabhakaran
35305	Prabir Datta	35350	Jagdish Prasad
35306	Madan Mohan Dey	35351	Sagun Vinayak Shirodkar
35307	Upendra Vinayak Salvi	35352	Gulab Singh
35308	Nilkanth Pundalikrao Fulari	35353	Moti Sardana

STUDENTS (*contd.*)

No.	Name
35354	Pushkar Narain
35355	Maleyanda Belliappa Nanjappa
35356	Sundar Lal Pawar
35357	N. S. Venkata Subramanian
35358	Krishna Chandra Garain
35359	Mohammad Amin
35360	Nampurath Krishnan Kutty
35361	Brijendra Kumar Goswami
35362	Gangaraju Ramakrishna Prasad
35363	Indu Prakash
35364	Jiwan Das Gupta
35365	Danbir Singh
35366	Dinesh Saran
35367	Brij Mohan Lal
35368	Keshav Datt Sharma
35369	Kartik Chandra Bose
35370	Onkar Swarup Kashyap
35371	H. K. Raghavendra
35372	Subir Kumar Banerjee
35373	Narayan Chintamanrao Nilatkar
35374	Suresh Ramchandra Phatak
35375	Gama Prasad Pandey
35376	Jagdish Narain Pandey
35377	K. E. Rajagopalan Unni
35378	Sushil Chandra Dubey
35379	Virendra Kumar
35380	Balaram De
35381	Venkatasubramania Srinivasan
35382	Cpl. Mriganko Chakrabarti
35383	Samir Kumar Mukherjee
35384	Natarajan Vembu
35385	Bijay Kumar Chakrabarti
35386	Raghuvir Singh
35387	Padam Raj Gupta
35388	Ramesh Pandurang Kanitkar
35389	Kashinath Gajanan Kharadkar
35390	Narayan Vishnudas Shinde
35391	Om Prakash Batra
35392	Ravindra Kumar Jain
35393	Vidya Ram Rajani
35394	Ramesh Chandra Jain
35395	Subramaniaiyer Narayanaswamy
35396	Salam Chandrasekhara
35397	Visheshwar Mukherjee
35398	Raj Mohan Sobti
35399	M. S. Venkata Ramaiah
35400	Bansi Dhar Vermani
35401	Pronob Kumar Goswami
35402	Surendra Nath Srivastava
35403	Hari Chand Khatter
35404	Vellore Amruthalingam Krishnamurthy
35405	Harbans Lal Gera
35406	Gurcharan Singh Deo
35407	Pertap Narain Tandon
35408	Mahur Venkatarao Gururaja
35409	Santosh Kumar
35410	Kamal Swarup Tandon
35411	Pati Ram Yadava
35412	Balwant Singh
35413	Ram Kumar Singhal
35414	Santokh Singh Paul
35415	Amrit Paul Singh Sydhu
35416	Manmohan Singh
35417	Dharm Pall Soni
35418	Vinod Prakash
35419	T. S. Panchanathan
35420	Suresh Chandra Gupta
35421	Ramesh Chandra Kapoor
35422	Omkar Nath Pajnoo
35423	Baljor Singh
35424	Krishan Lal Gulati
35425	Abdul Rashid Quarashi
35426	Chander Bhan
35427	Naresh Kumar Asija
35428	M. O. Srinivasan
35429	Syed Akram Basha
35430	Jitender Kumar Arora
35431	Shanti Swarup Mittal
35432	Vinay Kumar Agarwal
35433	Bhadraiah Krishnaiah Setty
35434	Surendra Singh
35435	Ravindra Kumar
35436	Sajid Husain
35437	Mahendra Kumar Jain
35438	Krishna Kumar Kaushal
35439	Holavanahalli Rangachar Ramachandrachar
35440	Triloki Nath Maini
35441	Santokh Singh
35442	Kishan Chand Rattan
35443	Idagur Boraiah Shivanna

STUDENTS (*contd*).

No.	Name
35444	Ababu Abraham
35445	Hanumant Prasad
35446	Krishna Autar Srivastava
35447	Jai Govind Singh
35448	Srinivasan Ramaswamy
35449	Tej Narain Misra
35450	Bhagwan Dass
35451	Virendra Kumar Gupta
35452	K. Subba Rao
35453	Badrinath Kangovi
35454	Tirumala Rangachary Venkatesan
35455	Mandayam Bhoolokam Narasimham
35456	Deshmukh Guru Raja
35457	Mariappa Sasi Bhushana
35458	Anandarau Subba Rao
35459	Belur Keshavaiyengar Sowmyakeshava
35460	Ramaswamiah Viswanath
35461	Venkatappa Ramachandriah
35462	Neeragunda Seshadri
35463	Krishnoji Rao Panduranga Rao
35464	Gottigere Seshagirirao Seetharama Rao
35465	Mysore Varadachar Venkateshananda Kumar
35466	Alok Kumar Chattopadhyay
35467	Brij Nandan Tewari
35468	Narinder Singh Kohli
35469	Vishwanath Singh
35470	Jarnail Singh Sijher
35471	Ghulam Nabi Wani
35472	Raj Kumar Singla
35473	Sudershan Kumar Sawhney
35474	Nagappa Dekappa Maroodi
35475	G. V. Pattabhiramayya
35476	Sant Sarup Chopra
35477	Gian Singh
35478	Ramakrishna Venkitachalam
35479	A. Gopala Iyer
35480	Govindan Rajendran
35481	Krishan Kumar Joshi
35482	T. Kochouseph Joy
35483	Y. R. V. S. Venkaji Rao
35484	Jacob John
35485	K. Varkey Mathai
35486	Narayan Chandra Paul
35487	Subramoniaiyer Vittil
35488	Raghunath Prasad Bajpai
35489	Shibendu Gupta
35490	K. Ravindranatha Varier
35491	Shanti Lal Godawat
35492	Bharatula Ramakrishnayya
35493	Ramchandra Shukla
35494	Kailash Nath Vishwakarma
35495	Durjyodhana Samal
35496	Bishun Narain Vaish
35497	Jagdish Anand
35498	Ajay Kumar Ghose
35499	Kasaragod Sadananda
35500	Kottarathil Asokan
35501	Ghanta Raghava Reddy
35502	Kakkanattu Cherian Mathew
35503	Thuruthikkat Kartha Dinakaran
35504	Mathai Thomas
35505	R. Narayana Panicker
35506	Toleti Someswara Rao
35507	T. Neelakantavadhayar Rameswamy
35508	Tarigopula Anankamma
35509	Srikonda Radha Krishnan
35510	Baij Nath Tripathi
35511	Palamootilvadakathil Jacob Koshy
35512	T. Karunakaran Nambiar
35513	P. Thomas Connittan
35514	V. V. Satya Bal Kutumbarao
35515	Jagan Nath
35516	Jacob Nainan
35517	Nandlal B. Vaswani
35518	Guntapalli Ganapathi
35519	Harish Chandra Agarwal
35520	Gora Chand Ghosh
35521	Nisar Ahmed Ansari
35522	Kocherlakota Bhaskararamamurty
35523	Mummareddi Ranga Rao
35524	Debraj Mohapatra
35525	Darshan Singh
35526	Venkat Balasubramaniam
35527	R. C. Das
35528	H. G. Srinivasa Rao
35529	Kapil Dev Sharma
35530	Sitarama Panda
35531	Garalapuraiah Subbaramaiah
35532	Laxmi Narayan Panda

STUDENTS (*contd.*)

No.	Name
35533	Thodaty Mohan Reedy
35534	Kassay Ganga Raju
35535	Vallabha Vaman Krishna Rao
35536	Puttuparampil Varughese Thomas
35537	C. K. Kunju Kunju Kutty
35538	R. Somasundaram
35539	Avinash Chandra
35540	Bhan Pratap Singh Raghuvanshi
35541	Gunda Apparao
35542	Dharam Pal
35543	Yashpal Sawhney
35544	M. K. Bhaskaran Nair
35545	Surendra Kumar Mahapatra
35546	Sk. Abu Bakar
35547	Cpl. Moor Kanat Sivadasan
35548	Bhagirath Lal Bhatia
35549	Deo Datt Tripathi
35550	Vazhakudiyil Varkey Varkey
35551	Vinod Mitter Sain
35552	Purnananda Rath
35553	Brij Kumar
35554	Kameshwar Prasad Srivastava
35555	Kailash Chandra Panda
35556	Manohar Lal Chachra
35557	Narendra Sahai Saxena
35558	Mohammad Shamim Ahmad
35559	Devarabhotla Surya Subrahmanya Sarma
35560	Ramesh Chandra Dhaundiyal
35561	Birendra Chandra Talukder
35562	Gurudeb Garanaik
35563	Maliackalmadom Narayanannair Rajan
35564	Soumendra Nath Roy
35565	Nanduri Bhaskara Rao
35566	Prem Prakash Pradhan
35567	Shiv Kumar Misra
35568	P. M. Kunhimohamed
35569	Ramakant Thakar
35570	T. G. Janardhanan Unnithan
35571	A. Kuriam Pathrose
35572	Kanchi Vittal Murthy
35573	Gyan Shanker Shukla
35574	Satya Paul Sarafia
35575	Guntakandla Somi Reddy
35576	Cpl. Khanderao Sonu Nigade
35577	Poovanitheruvath Maliyakkal Moideen Koya
35578	Abdul Qayum
35579	Mohammad Khalid Qureshy
35580	Chilakapati Veeraraghavacharyulu
35581	Rajendra Kumar Agrawal
35582	Ganesh Prasad Srivastava
35583	Vangara Mohan
35584	Subir Bhattacharya
35585	Joshi Krishna Murthy
35586	Dandu Satyanarayana Raju
35587	Cheralan Puthiyaveed Narayanan Nair
35588	Gurdial Singh Saini
35589	Sagam Venkata Siva Bhaskara Reddy
35590	Sat Pal Salehria
35591	Ramashis Puri
35592	Hari Ballabh
35593	Suresh Kumar
35594	Inderjit Singh Tathgur
35595	Nek Ram Sharma
35596	Tapala Jagan Mohan Rao
35597	Kivaluru Subramanya Sarma Krishnamurthy
35598	Jaswinderpal Singh
35599	Vegi Venkataramana
35600	Sarjit Singh Sodhi
35601	Ashvin Kantilal Pandya
35602	Prem Sagar Singhala
35603	Vankayala Durga Venkata Sri Krishnarao
35604	Chandra Prakash
35605	Krishan Kumar Mehta
35606	Som Prakash
35607	Sri Rabindranath Nayak
35608	Satyender Krishan Bhatia
35609	Krishna Venkatachala Rajan
35610	Chaman Lal Kochhar
35611	Dandapani Dalai
35612	C. Devassy Poulose
35613	Jagpal Rai
35614	Krishan Kumar Chauhan
35615	Vajjhala Venkatarama Rao
35616	Netra Pal Jain
35617	Vajrala Krishnaiah
35618	Vishwambhar Dayal
35819	Antolbhai Champakbhai Patel
35620	Dilip Kumar Guha
35621	Ganta Simhachalam Naidu

STUDENTS (*contd.*)

No.	Name
35622	Neelakantam Gopalakrishna
35623	Shri Pati Singh
35624	S. Sundaram
35625	Aswini Kumar Sahana
35626	Uttarkar Puttaswamyrao Mahabala Rao
35627	Addepalli Ganapathi Rao
35628	Paramjit Singh
35629	Maya Ram Sharma
35630	Umesh Pal Singh Aswal
35631	Amrit Sagar
35632	Chintam Mohana Reddi
35633	Ram Ishwar Singh Khurmi
35634	Jogender Singh
35635	Joseph Mathews
35636	Krishna Chandra Das
35637	Jangesh Chandra
35638	Veda Prakash Sharma
35639	Mohd. Jafar Hussain
35640	Docca Satya Raghavendra Rao
35641	Nandkumar Kapilashankar Adhvaryu
35642	Ghias Ali
35643	Mopidevi Sesava Rao
35644	Pottangadi Haridas
35645	Chandrika Misra
35646	Sadanand Prasad Sinha
35647	Qamarul Wasey
35648	Rishi Chand Goel
35649	Sunder Sham
35650	Sachindra Chandra Dutta
35651	Adithamu Sreekrishna Prasad
35652	Suri Subrahmanya Sastry
35653	Ram Lal Gupta
35654	Bharat Bhushan Sharma
35655	Rattan Dev
35656	Kambam Lakshminarasimham Balu
35657	Subhash Chander Gujral
35658	Fathimullah Abdul Hakeem
35659	Ravi Kant
35660	Radha Kishan Mittal
35661	Tati Sreerama Murthy
35662	Mahindra Nath
35663	Rich Pal Singh
35664	A. K. Kuruvilla
35665	Probodh Ranjan Guha
35666	Jagdish Rai
35667	Thummu Ramakrishnayya
35668	Banari Lal Anand
35669	Bhanu Prakash Goel
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35671	Naresh Kumar Raizada
35672	Vasant Rao
35673	Radhey Shiam
35674	Kailash Chander Puri
35675	Chitta Ranjan Chakraborty
35676	Nagabhirava Sambasiva Rao
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35707	Bansi Lal Gupta
35708	Sushil Kumar Diwan
35709	Manmohan Kalra
35710	D. S. Nageswara Chainulu
35711	Jai Parkash

STUDENTS (*contd.*)

No.	Name
35712	Priya Ranjan Sircar
35713	Jyoti Prakash S. Mathur
35714	Sohan Lal Sharma
35715	Guntur Shyamsunder
35716	Brij Raj Puri
35717	Ashok Kumar Bhambri
35718	Harishkumar Somabhai Pujara
35719	Cpl. Basavantappa Danappa Dolli
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35729	Manikchand Satyapal Anand
35730	Md. Ishaq Hussain
35731	Saraswatula Ramakrishna Rao
35732	Uttam Chand Gupta
35733	Puran Chand Sharma
35734	Raj Kumar Gupta
35735	Kalpanath Rai Sharma
35736	Nalin Kishore Mohanty
35737	Chennur Madana Mohana Rao
35738	Valavala Rama Mohana Rao
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35747	Narindera Kumar Sharma
35748	Mohammed Yahya
35749	Pallichedayath Padmajan
35750	Krishna Chandra Panda
35751	Sher Jang Bahadur Singh
35752	Gidugu Venkata Ramakrishna Rao
35753	Yerramsetti Venkata Ratnam
35754	Abnesh Chandra
35755	G. Satya Narayana Reddy
35756	Baladev Roy
35757	Shantilal Mahijibhai Patel
35758	Turuvekere Manjaiah Dharmaiah
35759	Purna Chandra Ghosh
35760	G. Madhavan Nair
35761	Nirmal Kumar Sengupta
35762	Krovvidi Suryanarayana
35763	Mohan Lal Puri
35764	Sarada Prasad Rath
35765	Sadasivuni Venkata Rama Krishna Patnaik
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35774	Des Raj Thakraj
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35777	Vauvegula Venkata Subba Rao
35778	Kanwal Nain Goyal
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35786	Ramesh Chandra Khera
35787	Cpl. Virendra Dutt Bahuguna
35788	Penumarti Radhakrishna Murty
35789	T. Harihara Subramonia Ayyar
35790	Pothuri Bhaskara Rao
35791	Srungavarapu Suryachandra Rao
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35794	Nageswara Rao Jonnalagadda
35795	N. S. Rao Gari Sreenivasa Rao
35796	Shiva Prakash Arora
35797	Suryya Kumar Bora
35798	Surindar Kumar Bhugra
35799	Purna Kanta Baruah
35800	Anil Kumar Das
35801	Ajay Kumar Sinha

STUDENTS (*contd.*)

No.	Name
35802	Santosh Kumar Garg
35803	Pramod Kumar Ailawadi
35804	Shaik Saad Hussain
35805	Hansraj Gulati
35806	Tarseem Lal Duggal
35807	Ramesh Chandra Srivastav
35808	Rishi Kumar Jain
35809	Hazari Lal Gupta
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35816	Komal Parshad Sharma
35817	Rajeswar Pandey
35818	Ved Parkash Kamra
35819	Annamraju Venkata Pandu Ranga Rao
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35821	Mahesh Raj Krishnatri
35822	Fidvi Hussain Khan
35823	Kailash Chander Chopra
35824	Sarat Kumar Jena
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35826	Rajinder Mohan Passi
35827	Chelujibhai Hathibhai Chaudhari
35828	Mahakaleshwar Shrivastava
35829	Jugal Kishore Sukhija
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35832	Mohan Lal Varma
35833	R. Shankaranarayana Rao
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35835	Kripa Nath Chaturvedi
35836	Arjun Chaturbhuj Chhabria
35837	Chander Gandhi
35838	Marumeni Varda Rajeswara Rao
35839	Ranajit Kumar Banerjee
35840	Tanmay Ray
35841	E. P. Varghese
35842	Behara Lakhmi Narasayya Sarma
35843	Surinder Kumar Nindrajog
35844	Ramesh Chand
35845	Amritlal Mohanlal Patel
35846	Madhukar Keshav Pathak
35847	Jagdish Kumar
35848	Sham Lal Aggarwal
35849	Raola Rajaiah
35850	Krishna Kumar
35851	Balbir Narayan Shinghal
35852	Krishan Kumar Dhir
35853	Bal Krishan Sethi
35854	Laljibhai Vallabhbhai Hirapara
35855	Malkit Singh
35856	Yohannan Daniel
35857	Andaluri Pattabhi Rama Rao
35858	Ramanujam Rengamoni
35859	Syed Mohammed Ahmed
35860	Gurbakhsh Singh
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35862	Vimal Chandra Sodhani
35863	Kartar Singh Beniwal
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35865	Surrender Singh
35866	Chhote Lal Garg
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35869	Jayanti Satyanarayana
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35873	Madapalli Kodanda Ramaraju
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35875	Rajanikant Pranlal Shah
35876	Birbal Vindar Pal Singal
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34878	Addepalli Siva Hanumantha Rao
35879	V. Augusthy Vincent
35880	Sudhakar Jagannath Bhagwat
35881	Sant Lal
35882	Chakravadhanula Sitaramayya Dhaveji
35883	Vedula Suryanarayana Murthy
35884	Madan Lal Jairath
35885	Madan Gopal Laljilal Kastwar
35886	Amalendu Das Gupta
34887	Jetty Prabhakara Rao
35888	Madan Lal Sabhlok
34889	Chaman Lal Bali
35890	Kiranchandra Shantilal Doshi
35891	J. Hanumant Rao Naidu

STUDENTS (*contd.*)

No.	Name
35892	Paladugu Gopalaswamy
35893	Amar Ditta Taneja
35894	Sudhakar Khare
35895	Darshan Singh Nangpal
35896	Kundany Narayanan Mohanan
35897	Narayana Ramaraju
35898	Nand Kishore Saigal
35899	Mohinder Kumar Sood
35900	Madar Hamid Khan
35901	Kailash Chandra Khattar
35902	Jugal Kishore Srivastava
35903	Shantilal Mohanlal Kumud
35904	Kedar Vinayakrao Gokhlay
35905	Ved Parkash Garg
35906	Kharaiti Lall Bazaz
35907	Sadhu Charan Senapati
35908	Kulwant Singh Pruthi
35909	Jaimuni Kumar Garg
35910	Netra Lal Singh
35911	Vir Bhan
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35914	Ramesh Chandra Tiwari
35915	Krishna Gopal
35916	Lakkavalli Narayanajois Ramachandra
35917	Lingam Sreeramachandra Murty
35918	Waman Gajanan Rao Ghatge
35919	Ajit Singh Ahuja
35920	Jatadhari Choudhury
35921	Bahadur Singh
35922	Krishan Chand Jain
35923	Manohar Singh Bhavra
39524	Krishan Singh Mayer
35925	Yarlagadda Radhakrishnamurty
35926	Surinder Kumar Vijh
35927	Gurugunti Devendrappa
35928	Sham Lal Goyal
35929	Mukund Govindrao Joglekar
35930	Vithalrao Raghavendrarao Mundewadi
35931	Jugal Kishore Jairath
35932	H. S. Sathyamurthy
35933	V. Cheria Joseph
35934	P. Parameshwara Herle
35935	Bellur Narasimhachar Seshadri
35936	Manthri Selvapullaiiyengar Vasudevan

No.	Name
35937	R. Muthukrishnan
35938	S. Shankaranarayana
35939	Nagara Gadde Raghavendra Rao
35940	M. V. Jagannath
35941	Gurmukh Singh
35942	Sudarshan Kumar Gulati
35943	Mallikarjunappa Bandeppa Karnatgi
35944	Savarimuthu Thomas
35945	Sgt. Vazhapilly John Francis
35946	Basheer Ahmed Khan
35947	B. Ramaswamy Nagaraj
35948	Belur Narasinga Sreenivasa Murthy
35949	Ramanathapur Keshavaiah Ramachandra Rao
35950	Aloysius Austin
35951	Sudhir Chandra Ganguli
35952	Cpl. Pran Nath Puri
35953	Bangalore Krishnaiyengar Sridharan
35954	Sgt. Ramdhani Singh
35955	Mohammed Inaetulla
35956	Cpl. Vasant Haghunath Vispute
35957	Kamalanabha
35958	Narayan Govind Bidkar
35959	M. N. Narayana
35960	K. Lakshminarayana
35961	Sribashyam Vijaya Kumar
35962	Cpl. Bimal Singh Robert
35963	Vaduvur Rajagopalan Srinivasa Raghavan
35964	Jwala Prasad Jha
35965	Rajaram Vasudeo Kulkarni
35966	Kasi Krishna Swamy
35967	Munisamappa Chandrappa
35968	Cpl. V. Gopal Rao
35969	Prabhakar Vishnu Bhagwat
35970	Manohar Dattatraya Chobbe
35971	Puthenvedu Korala Philipose
35972	Chenji Anantharao Krishna Prasad
35973	Hospet Pandurangarao Ramamoorthy
35974	Hejjaji Rudraiah Basavaraju
35975	E. Venugopal
35976	Yashwant Narayan Deshpande
35977	Venkatesh Raghavendracharya Bahuguni
35978	Hosur Nanjundarao Somasundaram
35979	Padipurakkal Sankaranarayanan

STUDENTS (*contd.*)

No.	Name	No.	Name
35980	Shashikant Ganapati Kamath	35987	Sadashiv Moreshwar Deo
35981	Kadaba Subramhanya	35988	Arun Kumar Sengupta
35982	Thuruthel Varkey Mani	35989	Shrikant Anant Supekar
35983	Mahadeo Gopalrao Bhide	35990	Maruti Huvanna Yelhurkar
35984	R. Gururaja	35991	D. V. Surya Gangadhara Sharma
35985	B. L. Ananthapadmanabhan	35992	Ramiah Sathyanarayana Murthy
35986	Lac Sunderrajan Rangaswamy	35993	Puliyur Srinivasan Vasudevan

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SITUATIONS WANTED

EXPERIENCED GRADUATE CIVIL ENGINEER, age 48 years, 24 years experience, 22 years in the Railways and 2 years in a paper mill and the Kosi Project, seeks employment. Minimum salary acceptable Rs. 1,100 per month. (Office ref. E.S.116)

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Signature of Publisher

PLAN OF EXAMINATIONS OF THE UNION PUBLIC SERVICE COMMISSION FOR TELEGRAPH ENGINEERING SERVICES (CLASS I JUNIOR)

H. N. Shrivastava
Member

Introduction

A notification issued by the Union Public Service Commission dated New Delhi, April 15, 1961, gives the rules of recruitment and the plan of examinations for Superior Engineering Services in India. A study of the above reveals that for the Telegraph Engineering Services (Class I) examinations the syllabuses for compulsory as well as optional subjects do not include telecommunication subjects but the bias of these syllabuses is for electrical and mechanical engineering. There has been such rapid developments in the field of telecommunication during the last decade that the previous methods used for network analysis and synthesis have been superseded by modern methods utilizing matrices, Laplace transform, and Fourier transform. The study of semiconductors, transistors, pulse techniques, electronic instrumentation, statistical information theory, and of V.H.F., U.H.F., S.H.F. and E.H.F. are essential for new entrants to the Telegraph Engineering Services (Class I) examinations. They should be up-to-date in the present day telecommunication subjects. They may need refresher courses, but if deficient in the modern theories, they will not profit by further training. The country has already entered into the field of design and manufacture of telecommunication equipment which call for a greater degree of specialization than before in electronics. Trunk dialling, if not the complete automatic telephone systems, will soon be worked by electronic circuits.

A comparative study of subjects for different examinations

In the above background, the compulsory and optional subjects provided for the Telegraph Engineering Services (Class I) examinations *vis-a-vis* the subjects for a few other Engineering Services (Class I) examinations are indicated below.

A. *Telegraph Engineering Services (Class I) Examinations*

(a) Compulsory subjects	Marks allotted
(1) English (including Essay and Precis)	100
(2) General Knowledge	100
(3) Electrical Communication Engineering	100
(4) Applied Mathematics	100
(5) Electrical Engineering	150
(6) Mechanical Engineering	150
Total	700

(b) Optional (any two of the following)

(1) Prime Movers	100
(2) Physics (including Electricity and Magnetism)	100
(3) Applied Mechanics*	100

B. Examinations for entry into Electrical Engineering Department

(a) Compulsory subjects	Marks allotted
(1) English	100
(2) General Knowledge	100
(3) Electrical Engineering	200
(4) Applied Mechanics*	200
(5) Mechanical Engineering	200
Total	800

(b) Optional subjects (any two of the following)

(1) Physics (including Electricity and Magnetism)	100
(2) Applied Mathematics	100
(3) Surveying	100
(4) Electrical Communication Engineering	100

C. Examinations for entry into Mechanical Engineering and Transportation Department of the Superior Revenue Establishment of the Indian Railways

(a) Compulsory subjects	Marks allotted
(1) English	100
(2) General Knowledge	100
(3) Applied Mechanics†	200
(4) Theory of Machines and Machine Design	200
(5) Prime Movers	200
Total	800

(b) Optional subjects (any two of the following)

(1) Hydraulics and Hydraulics Machines	100
(2) Electrical Engineering	100
(3) Metallurgy	100
(4) Workshop Technology	100
(5) Physics (including Electricity and Magnetism)	100
(6) Workshop Organization and Management	100

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* Reference may be made to item 4 of Appendix 2 of the syllabuses.

† Reference may be made to item 5 of Appendix 2 of the syllabuses.

D. Examinations for entry into Military Engineer Services (Class I) (Electrical and Mechanical)

(a) Compulsory subjects	Marks allotted
(1) English	100
(2) General Knowledge	100
(3) Electrical Engineering	200
(4) Mechanical Engineering	200
(5) Applied Mechanics*	200
Total	800

(b) Optional subjects (any two of the following)	
(1) Physics (Including Electricity and Magnetism)	100
(2) Electrical Communication Engineering	100
(3) Prime Movers	100
(4) Applied Mathematics	100
(5) Hydraulics and Hydraulic Machines	100

It will be seen from the plan outlined above that

(a) A total of 800 marks is allotted to compulsory subjects and 200 marks to optional subjects, thus making a grand total of 1,000 marks, in the case of examinations other than the Telegraph Engineering Services (Class I) where the grand total stands at 900 marks (700 marks for compulsory subjects and 200 marks for optional subjects).

(b) The marks reserved for Electrical Engineering and Mechanical Engineering as compulsory subjects is 200. In the Telegraph Engineering Superior Services examinations, however, the marks allotted for the subjects of Electrical Communication Engineerieg is 100 only. This is a great disadvantage to telecommunication engineers whose specialized knowledge is not utilized in the Telegraph Engineering Services (Class I) examinations.

(c) The Telegraph Engineering Services (Class I) examinations provides for 3 optional subjects only, while the other examinations include 4, 5 or 6 optional subjects. The optional subjects for the Telegraph Engineering Services examinations are: (1) Physics, (2) Applied Mechanics, and (3) Prime Movers. Excepting Physics, the other two subjects are not suitable for inclusion due to the reasons given below.

Applied Mechanics as given in the syllabus deals with building construction, design of trusses, foundations, retaining walls, chimneys, plate girders, reinforced concrete work, etc. Such specialized knowledge of civil engineering is not required for a telegraph engineer, especially, when the entire building work of the Posts and Telegraph Department is under the control of the Central Public Works Department.

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* Reference may be made to item 4 of Appendix 2 of the syllabuses.

Prime Movers is not an essential subject for a telecommunication engineer. A telegraph engineer gets power delivered within the premises of a telephone exchange or telegraph office by local electric supply undertaking. If however the candidate has to be examined in this subject, questions on it may be included in the papers for Electrical Engineering and Mechanical Engineering. These optional subjects should therefore be rationally substituted by other suitable subjects.

The drawbacks in the syllabus of the Telegraph Engineering Services (Class I) examinations may be corrected in the following manner:

(1) There should be an allotment 200 marks in the compulsory subjects for the subject of Electrical Communication Engineering which may be in two papers, *viz.*, (i) Line Communication Engineering, carrying 100 marks, and (ii) Radio Communication Engineering, carrying 100 marks. The syllabus will have to be suitably modified to include modern practices in the two fields. The total should be raised to 1,000 marks from 900, for the examination to be in line with the other examinations.

(2) There should be 6 optional subjects of 100 marks each, any two of which may be offered for the examination. These subjects may be

(a) Network Analysis and Synthesis, and Filters and Equalizers.

(b) Semiconductors and Transistors.

(c) V.H.F., Microwave, and Pulse communications.

(d) Auto-Exchanges, inclusive of Trunk dialling—Types, Design, Installation, and Maintenance.

(e) V.F.T. and Carrier on Overhead Lines and Cables. Coaxial Conductors and Wave Guides.

(f) Applied Mathematics for Telecommunication Engineers.

The only Class I Service examination which a telecommunication engineering graduate can legitimately try is the Telegraph Engineering Services (Class I) examination. The syllabus of that examination is, however, defective and keeps out telecommunication engineering graduates from sitting in that examination. Also, the service itself suffers since, properly trained graduates are denied admission.

It is the prerogative of the Institution of Engineers (India) to point out these anamolies to the Chairman of the Union Public Service Commission and to the Ministry of Transport and Communications for rectification. The Institution should recommend the formation of a committee under the chairmanship of an engineer-member of the Posts and Telegraphs Board. The other members of the committee should include a representative of the Institution, two professors of telecommunication, and representatives of the Posts and Telegraphs Department. The proposed syllabus taking into consideration the facts given above should be as given below.

Proposed syllabus for Telegraph Engineering (Class I) Examinations

(a) Compulsory subjects	Marks allotted
(1) English (including Essay and Precis)	100
(2) General Knowledge	100
(3) Line Communication Engineering	100
(4) Radio Communication Engineering	100
(5) Electronics	100
(6) Electrical Engineering	150
(7) Mechanical Engineering	150
Total	800

(b) Optional subjects (any two of the following)	
(1) Network Analysis and Synthesis	100
(2) Semiconductors and Transistors	100
(3) Pulse Techniques and V.H.F.-to-Microwave Communications	100
(4) Auto-Exchanges, inclusive of Trunk Dialling—Types, Design, Installation and Maintenance	100
(5) Carrier Current Engineering	100
(6) Applied Mathematics for Telecommunication Engineers	100

ADDRESSES OF CHAIRMEN AT THE ANNUAL GENERAL MEETINGS OF THE LOCAL CENTRES

Bihar Centre

Chairman's address by Shri D. Mookerjea, B.E., M.I.E., at the 16th Annual General Meeting of the Centre on December 23, 1962

The Chairman welcomed the Chief Guest, Shri M. Ananthasayanam Ayyangar, Governor of Bihar, and other invitees, and thanked the Committee of the Centre for electing him Chairman for 1962-63.

Delivering his address, Shri Mookerjea referred to the Chinese aggression, and said, 'We are meeting under the shadow of a crisis and I am conscious of the difficult task ahead of me. But I have ventured to accept this responsibility with confidence because I know I will have the necessary guidance from my colleagues and experienced predecessors.

We all are aware of the difficult days which are ahead of us owing to the treacherous attack of the enemy on our dear Motherland. We, especially the technical men, have to take up this challenge not by addressing lectures and meetings, but by devoted hard work. Let us take the pledge that we place our services at the disposal of our Government in this critical hour and that we are prepared to do any kind of work that may be assigned to us. Need of technical men is never so great as in times of war, and the technical men of India, I am sure, will never fall behind in carrying out their duties for saving the Motherland. We should rise to the occasion and dedicate ourselves in making our democracy successful and our Motherland strong.

The science of engineering is not static. Continuous research is necessary to develop new methods, new techniques, new criteria and new processes. The fields of research, both applied and fundamental, are so vast that there is unlimited scope. Research takes time and pays dividend in the long run. This is often considered by a certain section of the people as an unnecessary investment and as something-abstract which have no application to every day problems met with by the engineers in the field. Engineers can contribute towards quicker progress and lesser cost by having a research outlook in all their activities. The Institution is always anxious to develop this outlook and facilitate such activities.

A democratic society which our Government wants to establish cannot afford to ignore the development of its technology. It is dangerous in times of peace and more so in times of war to ignore technology and the technical men. The Institution is grateful to the Government of Bihar for the gift of land for the proposed building of the Bihar Centre of the Institution. The construction of this building has now taken definite shape and we look forward to the generosity of our Government for a handsome contribution so that the construction can be expedited and the Centre's activities enlarged. As soon as the additional facilities as provided for in the new building are available, our Centre will be of much greater assistance to the industry and will be able to render assistance to the Government on engineering problems confronting the State from time to time.

The younger generation of engineers have a stupendous task in developing the country, and in doing so, they must cultivate the habit of pursuing the latest scientific developments. It is for this purpose that we have attached considerable importance in setting up an up-to-date technical library and museum in our new building.

To achieve our objectives in the Third and subsequent Plans, we require a large number of engineers. Though steps have been taken to train more engineers and technicians, there is considerable leeway still. Our annual output of graduate engineers in the country is around 12,000, whereas the annual output of graduate engineers in the U.S.S.R., is about 112,000 now. As there has been a sudden expansion in our system of technical education, there is a general slackness in the quality, more emphasis being paid to quantity. This may solve our immediate problems, but sacrifice of quality in favour of quantity will lead to dangerous consequences. This aspect has not been given enough consideration particularly in this State, as the control of engineering education has been left to the care of neither engineers nor educationists. The set-up of the engineering services in the public sector is not conducive to attract the best talents. Some radical changes are necessary if we are serious about getting the maximum out of each rupee we spend for our development works. Our country has a distinct advantage in having a large reservoir of manpower. There is an immense resource of agricultural land but never intensely cultivated, large resources of minerals and industrial bases and large potentials of power, never intensely explored and harnessed.

In planning quick development on a wide scale, a decision has been taken that the nation's limited resources should be properly harnessed and directed into channels where they can be used most effectively. There is not much time to spare nor any to waste. Under the two Plans, our agricultural production has gone up by 30% and industrial production by 50%. If we want to catch up with the phenomenal increase in population, we have to augment our production many times more. It is also necessary to lay more emphasis on family planning in our Five Year Plans. During the present Plan period, new steel mills will roll into production, new dams will provide power and water for irrigation, and many other projects will add to the nation's economy. We have entered upon a crucial stage of development. Tempo and momentum have been built up. We must now gear up our activities to be able to 'take off' and ensure a self-generating economy.

In this task, we, engineers, are already playing and have still to play a significant role. Let us pledge ourselves to this noble task even at the sacrifice of our comforts, prestige and conveniences so that the posterity will have a far better standard of living.

The wellbeing of our people depends largely on planned development in the present economic set-up. If we have to catch up with the progress and developments that we find in the Western countries, our rate of progress must be accelerated, our-output of work per capita must be increased. We have, of course, the advantage of adopting the modern techniques and methods which the West have developed after years of research and experiment. Our people must be made technology-minded. We must give up the slow moving carriage and adopt something speedier, something more scientific. We cannot depend on a bent steel rod as our plough, we must put in more modern equipments which produce more yields from the same fields. Our steel industry must be developed, and it is only through steel and heavy industries that a nation can stand on its own legs both for fighting a war and for improving the living standards of the common man. It is with this end in view that our Government has embarked on the Five Year Plans, and the progress made so far was not only striking but significant. By no international standards, our rate of progress during the last 12 years could be taken as substandard. The present aggression has, of course, put some brake on our progress by diverting some of the available resources for defence purposes. Even then, it is amazing to see the rate at which we are building up the leeway left by the British rulers.

I like to highlight the tremendous importance that the developed countries like the U.S.A. and the U.S.S.R. have attached to technology and the technical men in the context of an accelerated pace of development. Here in India, though things are changing for the better, the steel frame administration left behind by the Police State has got into power and prominence. Had the technical men been put in places of position, perhaps, the pace of development could have been faster still. During my recent visit to the U.S.S.R., I noticed that even such posts as Chief of Foreign Affairs, Director of Administration, Public Relations Officer, etc. in the Ministry of Construction of Power Stations, are manned by technical men who know what they are talking about. In the U.S.A. also, President Roosevelt had put in considerable emphasis on the role of technologists during the Second World War and subsequent periods. I am afraid, for some reason or the other, we have not been able to develop that technological climate, because perhaps we are too much wedded to peace time methods and routine systems of civil administration. As I have already remarked, there is a distinct change in the present trend of thinking, and the sooner we harness our vast man-power and natural resources, the better it would be for the country. There is at present little respect for technical men in the society, because people throng to those who wield power and distribute favours. Delays in development of science and technology permanently cripple the society, and it will take considerable time before we can be normal again. There is no time to lose. The engineering profession needs to be energized and a scientific climate has to be developed to build a new India—the dream of our beloved Prime Minister. Have we been able to develop that climate which induces faster developments at lesser cost to the tax-payers? Is the present climate and attitude suitable for the growth of engineers? Consideration, respect, status, and prestige do not cost money. I must however confess that our profession does not command that consideration and position in the society today. The reason is also not far to seek. The public naturally looks to those in whom power and distribution of favour are concentrated. Though our activities have the most direct impact on the life of the people, a barrier has been placed between. Sooner or later this has to be removed. The sooner it is done, the better it would be for the country. In this respect, a clue from the U.S.S.R. could perhaps be a useful and valuable guide. Scientific and technological services receive highest consideration there, and it is hardly necessary for me to say that the country has reaped a good dividend.

Each action or decision of an engineer is open to criticism. Unfortunately, there is a growing tendency to focus the public attention to the failures and shortcomings of engineers and highlight the commendations bestowed on those placed in positions of authority without responsibility. This is rather a dangerous approach and unless nipped in the bud, the technicians would try to play safe, thereby substantially increasing the cost of investments on works. Considerable achievement and economy can be attained through bold and unorthodox steps provided the authorities concerned give reasonable support and protection to progressive ideas of engineers. Traditional bias sometimes comes in the way of an engineer adopting unconventional methods and materials. He would make a good and successful engineer who is prepared to take calculated risks. In all progressive countries of the world, such cases are not only encouraged but often rewarded.

We, in Bihar, have taken up magnificent projects in the irrigation, power, and industrial sectors, but somehow the atmosphere has not been so far congenial for rapid growth of subsidiary industries in the private sector. The Government will have to think in terms of not only providing loan to private industrialists, but a proper climate has to be set up so that the prospective industrialists looking for land, water, power, communication and transport facilities do not get completely lost in the administrative puzzle. Conditions must be created in which industrialists would be attracted to start industries right near the steel producing and heavy industries centres. A chain of industries is the prime need of the hour, and the more delay we make in this direction, the more dependant we will be on foreign countries not only for the production of our peace time equipments and machinery but for armaments also, the need for which has been keenly felt during the last few months. A sense of urgency has to be created and a sense of awareness developed in the different spheres, and an extensive blue print should be prepared and kept ready. I must reiterate that the set-up meant for developing industries needs thorough overhaul and proper orientation. We have until now devoted our attention towards developing the administrative set-up only, but the technological set-up which is fundamental to an industrial climate has not been given the attention it deserves. The result has been that we are lagging very much behind our target in this direction.

Before I conclude, I call upon my brother engineers to emulate the examples of those distinguished engineers like the Late Sir M. Visvesvaraya, and Dr. A. N. Khosla. We should all feel proud of our profession and the opportunities that we have received to serve our country and the people. We must dedicate ourselves in the task of wiping out poverty for good, and to ensure the same standard of development as has been attained in the Western world. We must always bear in mind that our mistakes remain always on the surface to be cursed by the people forever, whereas in the case of other scientific professions, such mistakes promptly go underground.

A recent survey by the Planning Commission indicated that more than 60% of our families have an income of less than Rs., 100 per month. Unless we can increase our production in the agricultural and industrial sectors, the objectives of a socialistic pattern of society will remain a pious wish. I personally feel that revolutionary changes in our land tenure system to stop fragmentation of holdings, and labour laws for correlating the wages and the outturn are called for in the initial stages of our development. But let us do our very best by giving more hours of intensive work so that our communities can have a better standard of living.

Bombay Centre

Chairman's address by J. G. Bodhe, B.E., M.I.E., at the 41st Annual General Meeting of the Centre on December 27, 1962

After welcoming the Chief Guest, Shri M. S. Kannamwar, Chief Minister of Maharashtra, and other invitees, Shri Bodhe thanked the Committee of the Centre for electing him Chairman for 1962-63.

Delivering the Chairman's address, he referred to the Chinese aggression and said, 'We are meeting under the shadow of an emergency forced on us by the wanton aggression of a country with whom we had maintained cultural and friendly relations from time immemorial. This war is forcing us to divert our energies from peaceful pursuits to the defence of our nation, thereby forcing a setback to our plans of development.

Modern wars are completely technological. Therefore, every engineer by his technical knowledge, skill, industry and determination can make a vital contribution to the development of India's industrial potential, and thereby contribute directly to the country's defence. In times of war, industry needs to be immediately geared to the production of armament in addition to civilian requirements ; war demands diversion of many engineers to defence, and the setting up of many industries, lines of communication, roads and bridges, air fields, dock yards, etc. which can maintain an uninterrupted supply. Also, an urgent programme of research in all fields of technology has to be launched.

The efforts to win a war have always prompted the technologists, scientists and engineers to give their very best, resulting in rapid and outstanding advances in technology, which even long periods of peace would not have produced. The military potential of a nation depends on its advancement in heavy industries which could be readily converted in emergencies and geared to military production. The basic defence of the country, therefore, lies in the development of its basic and heavy industries which provide the necessary potential for defence.

Building up of an industrial potential requires a huge reservoir of technical and scientific personnel and demands rapid developments in education. The enemy aggression has brought to light the lacunae in our first and subsequent lines of defence.

It is therefore pertinent to analyze how we as a community can contribute effectively to the preparedness of the country and its defence. In engineering colleges, a short course in military science and technology could be introduced, which will enable the engineering students to have sufficient idea of the engineer's role in defence organization. Engineering students should under go military training for at least two terms, to be continued by periodical training camps up to a certain age limit. A register of all such persons who have obtained military training, and also of those who volunteer to go to active service could be maintained. School and college students should compulsorily go through a physical and military training course, thus creating a pool of personnel for civil defence.

With the stepping up of the industrial development in the Third Plan and that visualized in the Fourth Plan, the requirement in all categories of technical personnel is bound to increase tremendously. While Government is doing its best to increase the number of engineering colleges, polytechnics and architectural schools and colleges, private institutions can supplement this effort, if they are encouraged and subsidized by the Government. Practical training in workshops and industries is extremely inadequate, and this is bound to hamper and inconvenience the maintenance of industries and efficient turnover. The Institution is playing an important role in holding examinations and maintaining a proper standard of qualifications so essential in the case of technical personnel.

It is undeniable that the calibre of the students admitted to the engineering colleges is reasonably high. It is, therefore quite distressing to find that the failures at the examinations range up to 50%. Evidently, the fault does not always lie with the students, but with the system of education and the mode of examinations. The students coming out of the universities should be well ground to tackle problems from first principles and acquire experience in their applications. Engineering education in the colleges is admittedly deficient. Students coming out of the colleges lack practical approach and are found to be inadequate to serve the industry or in an engineering office immediately. This situation could be remedied if the course in engineering is sandwiched with experience in the field and factories. Also, the student should be taught not only engineering but should go out in the world equipped with ability to express himself in writing as well as in speech.

Professors and teachers in engineering colleges are deficient in practical experience and are not in touch with construction and design in practice. It is, therefore, suggested that practicing engineers should be invited to give part time services in the universities, and professors in the colleges should be allowed to have private consultations. This will affect the engineering education profitably, providing it with the practical bias now lacking.

In a democratic set-up, engineers need not necessarily be silent executors of works but can also take an effective part in guiding the policies of the Government. We should make better efforts to send eminent members to the various legislatures to represent the engineering fraternity.

More than 10% of the constructional activities in India is concentrated in and around Bombay. A need, therefore, for a testing laboratory and a research centre for building materials is acutely felt. Consultants are very often handicapped for want of research and testing facilities to carry out tests on model structures of bold and unusual designs. If the laboratories are easily accessible for solution of problems, original thinking will be encouraged. Research facilities can be provided at the university and other teaching engineering colleges. A mention can be made of the department of Technology of the University of Bombay which carries out research and gives solution to problems in industry, with immense advantages to the industry and the teaching staff as well.

A colossal amount of work has been executed in the shape of major engineering projects in the last two Five Year Plans, about which no information or scanty information is available. It should be made incumbent on the engineers who are in charge of the design and execution of these projects to publish full and comprehensive reports on all the project aspects covering the design, costs, special difficulties encountered, and the methods by which they were solved. This reservoir of information will be of immense use to the country at large for future progress. The Institution can set up, with the assistance of the Government, a special body to gather such information.

In the pre-independence era, large projects and industries were designed and supervised by consultants from abroad. The consulting engineers in this country were, therefore, only a synonym of structural consultants in the private sector. Even after independence, no attempt has been made to build up a cadre of consulting engineers or to encourage and associate Indian consulting engineers with the projects that are now being undertaken. The knowhow for such projects naturally comes from the countries whence we are deriving financial assistance. Indian consulting engineers, therefore, have no opportunity of acquiring experience and data and statistics so valuable for future application. All this information in the hands of the Government Department concerned remains stagnant, and the engineers at large miss their benefits for wider use. All these projects when completed, are meant to be maintained and extended by the talent in this country. It is therefore necessary that Indian consulting engineers are be associated with the foreign consultants, so that they can gain and enlarge their experience and utilize the same on future projects. This will make the country self-reliant in technological knowhow and save foreign exchange. Moreover, Indian consulting engineers, knowing the local conditions and resources, can usefully modify the specifications in the best interests of the country. Foreign consultants, conditioned to think in different environments are apt to use methods and materials to which they are accustomed. It is only the local consultants who can use the indigenous materials and machinery and strike a harmonious means between local labour and mechanization. The Government should make it obligatory that whenever foreign consultants are employed, they must necessarily associate themselves with Indian consulting engineering firms.

All the Government projects, small or big, are still handled by the Public Works Department in the matter of design as well as execution. Although we find many outstanding engineers in the department, it will not be wrong to say that the department, due to its very set-up and being embroiled in rigid red-tape and overloaded with work, is incapable of having a radical outlook, as compared with the private consultants.

As an example, the bridge construction in this country is still following routine and monotonous designs, and no new outlook is brought to bear on this subject. The majority of the public buildings look drab and distinctly outmoded and mediocre. No attempt seems to have been made to make these structures aesthetically pleasing and harmonize them with the landscape in which they are situated.

Association with private consultants can bring a fresh and original outlook to the project, by better designs, originality of concept, and quick execution.

It is hoped that, as in other countries, the railways, public works departments, local authorities, military engineering services and public corporations will play their part in encouraging to build up a cadre of consulting engineers.

The Institution of Consulting Engineers is a body affiliated to the Institution of Engineers (India) and was founded in 1958. The membership is open to engineers practising independently for a period of more than five years. It is hoped that all those engineers who are eligible will join this institution in large numbers and build up a cadre of consulting engineers in our country.

The present policy of retiring senior engineers needs revision. The services of an experienced engineer are prematurely terminated at a time when he is at his best and perhaps in the middle period of the execution of a project. Services of such engineers should be extended till the completion of the project. After retirement, they could join a pool of engineers and continue to give their useful service in a consultative capacity utilizing their energies and talents usefully, especially when there is an acute shortage of technical talent in the country.

In the last 15 years, we have tackled many serious problems and achieved considerable progress in many fields; however we cannot admit but our deficiency in providing housing for the poor and the middle classes. Construction of houses contributes substantially to the general happiness and industrial activities of the community. Our housing programmes should advance simultaneously and adequately with our industrial expansion. The engineers and the building industry can play their part by utilizing modern techniques of prefabrication and standardization for speedy and economical construction of middle class housing. Housing brings us to the problems of growth of industries in and around major cities.

The city of Bombay, which had a population of 23 lakhs a few years ago, is now going beyond the figure of 42 lakhs and it is estimated to reach a figure of 60 lakhs by 1970. The present area of Bombay and that of extended suburbs is about 165 sq. miles and on reasonable standards of living, it is capable of accommodating a population of 32 lakhs. What should be our approach to this population problem? In commercial localities, vertical development by constructing tall multistoreyed buildings should be encouraged in place of outmoded structures. This will result in the occupation of less space on the ground, thus providing reasonable open spaces all around and creating an impressive and interesting skyline for the city. The residential population should be encouraged to move away into the suburbs, creating self-sufficient centres. Further dispersion can be effected by the creation of satellite towns and garden cities around Bombay. Over and above this, it will not be wrong to predict that the city will be faced with water famine in the near future affecting the efficiency of the drainage system and the hygiene of the city, if urgent steps are not seriously undertaken by the Government.

The present road system of Bombay runs mainly north and south, and is today carrying a traffic more than 20 times than what it was intended for. This system is incapable of being augmented, improved or enlarged. The railways have exceeded the optimum capacity. The number of vehicles on the roads is now much beyond 80,000 and it is expected to reach the 100,000 mark.

The steps undertaken so far to this baffling problem are the construction of the Eastern and Western Highways and a bridge across the Thana creek. These provide only a partial relief ; however, the main bulk of traffic will still continue to choke the arteries of Bombay.

The means of achieving a balanced development of the population scheme on the main land and the dispersion of traffic from and into the city lies in the construction of a suspension bridge connecting the Fort Area at Apollo Bunder on the island with Uran on the main land which is only 3 miles away. The approach to this bridge at the city end located at Apollo Bunder, will afford the shortest possible exit from the main source of heavy traffic which is generated from the Bombay docks and the railway goods yards of the Central and Western Railways situated hardly a mile away. The cost of this project is estimated at about Rs. 30 crores, but the scheme can be justified even as a commercial proposition.

The Government should be complimented for the action of appointing traffic consultants to study the traffic problems of Bombay. As a first step towards removing bottlenecks, a number of underground crossings and subways should be undertaken at all road junctions. This will considerably eliminate traffic delays due to pedestrian crossings.

It is suggested that a tunnel be constructed under the Malabar Hills and continued by providing a boulevard along the western sea face parallel to the Hornby Vellard Road, extended further up to Bandra to join the western highways. This is a commendable solution. However, the tunnel under the Malabar Hills is likely to create a bottleneck at Chowpatty. This can be eliminated if a separate road parallel to the Marine Drive is constructed from the Fort area at Nariman Point and connected to the tunnel at the Malabar Hills. This will enable Marine Drive to be utilized for the internal short distance traffic and will eliminate overcrowding of the Queens Road which can better serve central Bombay.

Possibilities of constructing an elevated roadway from Bori Bunder to Dadar and up to Sion can be examined to relieve the surface traffic from Mohammedali Road going northward. This roadway can be 20 to 30 ft. wide and should not prove to be an obstruction to light and air to the adjoining buildings, nor encroach on the privacy of the occupants of these buildings.

The present road system of the southern and central parts of Bombay is not feasible to serious improvement. An underground railway, therefore, will provide an ideal solution for relieving this traffic congestion. The Western and Central Railways can be interconnected by an underground network, to be effective in relieving pedestrian traffic as well as the pressure on bus traffic. It will be disastrous for the economic life of Bombay to postpone the implementation of schemes for relieving traffic congestion.

Due to the scarcity of building area in Bombay, vertical development is being proposed and encouraged. The following points have to be carefully considered in the design of these structures: (i) foundation design; (ii) design of the framework in concrete or steel, to withstand wind and settlement stresses, for bending, shear and rigidity; (iii) corrosion of reinforced concrete and steel members, and considerations of fatigue in cantilevered projections; (iv) provision of sanitary and other services accessible to maintenance and repairs and replacement; (v) maintenance of electricity and water supply; (vi) waterproofing of terraces and balconies; (vii) maintenance of lifts and fire fighting equipment, (viii) provision of standby for water pumps, water tanks, etc.; (ix) periodical cleaning of windows; (x) construction techniques for tall structures which require installation of lifts and hoists for the purpose of vertical construction, (xi) provision of light weight partitions; (xii) hollow floors employing light clay blocks; (xiii) prestressed floor and roofs, and (xiv) new ways and means to reduce the dead load on structures.

Founded over 40 years ago, the Institution of Engineers (India) represents the entire engineering fraternity and claims a membership of over 40,000. It functions through its various Local Centres and Sub-Centres, and disseminates technical knowledge and provides a forum for technical papers through the *Bulletin* and *Journal*. Its Corporate Membership is a valued qualification and is considered equivalent to a degree in engineering. The Government of Maharashtra had been kind enough to make available a piece of land at Clerk Road, Mahalahsmi, for the construction of a building to house the Bombay Centre of the Institution. The Government has always acclaimed the part played by engineers in the progress of the nation; and it is hoped that the Government will give concrete shape to this appreciation by giving financial assistance for the construction of the building and by waiving the annual liability of Rs. 8,000 (as lease rent) for the land allotted for the building.

The engineer's life in the profession is activated by a triple purpose; (i) the need for creation, (ii) the need for promotion (*i.e.*, desire to learn more and better), and (iii) the need for service (*i.e.*, thirst to overcome instinctive egotism by giving the best to the service of an ideal). It is a natural urge on the part of the engineer to justify himself through his works and his creations. The joy he derives from the works created by him is sufficient to compensate the troubles he takes in his professional life. It is this urge of creation which prompts him to give his best not only for himself but for the society. The engineer is not merely a means of material advance but, in the ultimate analysis, he is a producer of a culture. All cultures culminate in moral happiness to mankind and here, it is the ultimate aim of the engineer not to resist or oppose nature, but to use nature to the benefit of the society.

Summaries of Papers Published in the Journal, Vol. 43, no. 7, pts. CI 4 and ME 4, March 1963

CIVIL ENGINEERING DIVISION

Drag on a Rough Oscillating Plate

Dr. S. K. Baruah
Associate Member

In this paper, a mathematical interpretation of the phenomena of drag on a rough oscillating plate is described. This investigation is based on the experimental results of Bagnold and is done in the light of resistance due to periodic motion in cylinders. The experimental set-up involves complicated apparatus and a careful layout, nevertheless such an experiment will be of interest.

Recent Advances in Soil Engineering

Dinesh Mohan
Member

The advances in the field of soil mechanics described in the paper are only a few of the many and there is little doubt that soil mechanics has finally established itself as a science not to be ignored but to be seriously considered in all major constructions of the future. Brief references are made to nuclear methods of measuring *in situ* density and moisture content, the use of pressure meter for *in situ* testing of foundations, penetration tests, use of vibroflotation and explosives for compaction of loose sandy strata, etc., as an illustration of the rapid progress that is being made in this field.

Mechanization of Building Operations

M. L. Jain
Member

Rationalization in construction and increased productivity in building are being tried in various ways. These can be achieved through coordinated measures at the planning stage, in respect of layout and siting of buildings, construction techniques, building materials and methods, and management and works organization at the site. The purpose of mechanizing the work on building sites is twofold. On the one hand, it aims at making the work quicker, accurate and more rational, thereby lessening the cost of construction. On the other hand, replacement of manual work by mechanical operations is an important factor in improving the working conditions within the building industry which has so far been characterized by monotonous physical work.

Methods for Estimation of Ground Water Storage

S. Subba Rao
Non-member

The fundamental difference between the equilibrium methods and the non-equilibrium methods used for the estimation of ground water storage lies in the time factor introduced by Theis in his basic equation for the non-equilibrium flow. This concept will provide accurate predictions of well performance when continuously harnessed and will also enable determination of the storage coefficients more accurately. Another distinct advantage of non-equilibrium methods over equilibrium methods is that they enable determination of hydrological boundaries which are useful data in forecasting the future performance of the well field. It is interesting to note that with a little more expenditure for sinking one or two observation wells and conducting an accurate pumping test, the performance of wells can be predicted with more confidence than with the yield test data of a single pumped well only. This is very useful particularly when a large water supply or a large tube-well irrigation scheme is proposed, because such schemes can be undertaken with confidence as the chances of failure can be predetermined. It is hoped that this paper will be of some interest to engineers and geologists who are concerned with ground water exploration work.

Strength of Prestressed Concrete Beams under Combined Bending and Torsion

Dr. Narayanswamy
Associate Member

Torsional stresses generally occur as a secondary effect of bending. Concrete is weak in tension and this makes the problem of combined bending and torsion very important in concrete construction. Prestressing can be advantageously used to reduce the principal tensile stress and thereby increase the torsional resistance of concrete. The elastic theories of failure cannot satisfactorily explain the behaviour of concrete under various stress combinations. It is, however, possible to draw interaction curves for combined bending and torsion, and hence assess fairly accurately the strength of prestressed concrete beams under such loading.

Ultimate Torsional Strength of Concrete Sections

G. S. Pandit
Non-member

The paper presents the plastic theory for plain and reinforced concrete sections. Full plasticity in concrete is assumed, and shear reinforcement is assumed to attain yield stress at ultimate load. Circular and rectangular sections reinforced with spirals or longitudinal bars and stirrups are considered. Theoretical values of ultimate torsional moment are compared with test results.

Analysis of a Shallow Funicular Shell by the Method of Finite Differences

V. P. Apte
Associate Member
and
B. S. Phadke
Associate Member

The analysis of a shell roof of double curvature for a Municipal Council Hall is given using the theory of shallow funicular shells. The theory is economical and suitable for the use of concrete which has a good compressive strength. In the analysis, the method of finite differences is employed and the resulting equations are solved by Crout's method for simultaneous equations. To give a comparative basis for the results, the problem has also been solved by the energy method of Biezeno and Coch, employed previously by one of the authors for the analysis of an auditorium shell roof. Though both the methods are approximate, there is a fair agreement in the final results.

Plano-Concave Shells

M. N. Keshava Rao
Non-member

A new form of shell with the top surface plane and the bottom surface curved, which may be called a 'plane-concave shell', is introduced and its advantages for certain applications are outlined. The bottom surface is shaped as a paraboloid of revolution. Using equations similar to Marguerre's, the distribution of stresses and moments are obtained by Galerkin's method under Navier type boundary conditions. Tables for stresses and moments in square plano-concave shells are given for self-weight as well as for uniform superload.

Experimental Analysis of a Continuous Cylindrical Shell

S. P. Sharma
Non-member,
R. Das Gupta
Non-member
and
K. S. Shishodia
Non-member

This paper presents a model investigation of a continuous cylindrical shell designed by the Central Building Research Institute, Roorkee. Electrical strain gauges were used to measure strains on a perspex shell supported on araldite traverses. The results show that the analysis, based on A.S.C.E. tables and the continuity corrections proposed therein, is inadequate but usually errs on the safe side.

MECHANICAL ENGINEERING DIVISION

Application of a Commercial Diesel Engine for Measuring Cetane Number

V. Lakshmi Narayanan
Member

B. L. Maheshwari
Non-member

and

K. P. Mathur
Associate Member

Cetane number is a measure of the ignition quality of a fuel, judged by the length of delay between fuel injection and ignition. It is significantly related to engine performance characteristics as regards starting and smoothness of operation. Smoke and exhaust odour vary to some extent with the cetane number. For a given volatility, the fuel of lowest cetane number that will permit proper combuston gives the best fuel economy or power output. The American Society for Testing Materials cetane unit and the German cetane unit have become the principal units for determining the cetane number but they are not easily obtainable on account of the difficulties in getting foreign exchange, import licences, etc.

This paper discusses the application of a commercial four stroke Diesel engine in determining the cetane number of a Diesel fuel. Tests were conducted on a number of commercial engines, *e.g.*, Dueutz, Gardner, etc., using the throttling principle. The set-up is simple and the results are reproducible and are in close agreement with the A.S.T.M. cetane unit.

Distributive Nature of the Kinetic Coefficient of Friction at Chip-Tool Interface

A. K. Majumdar
Non-member

N. Ramaswamy
Non-member

and

A. Bhattacharyya
Associate Member

The heat flux distribution at the chip-tool interface is evaluated by a conducting paper analogue. The resulting frictional forces as calculated from thermal energy considerations are compared with dynamometrically measured values. The frictional behaviour of the sliding chip is investigated from which conclusions with regard to the distributive nature of the kinetic coefficient of friction at the chip-tool interface may be drawn.

Investigation of the Stiffness of a Horizontal Milling Machine Under Static Load

A. Chakravarty
Associate Member

Machine tool designers recognize the need for greater stiffness in machine tool structures. But there are many problems yet to be solved before stiffness can be predicted to close limits of accuracy without building the machine tool first. An account is given of an investigation conducted by the author to determine experimentally the deflections of the column of a horizontal milling machine under a static loading system and compare the results with those obtained from theoretical considerations, the column being assumed to be subject to identical loads. It was found that the experimentally obtained values of deflections were in each case higher than the calculated results, and the conclusion was drawn that, because of insufficient knowledge with regard to the behaviour of a loaded machine tool structure, the assumptions made for the calculations resulted in higher values of stiffness.

INSTITUTION NOTICES

Rail concession to delegates attending the 43rd Annual Convention

Further to the withdrawal by the Railway Board of the rail concession due to the National Emergency, a request was placed before the Railway Board for a resumption of the rail concession to delegates attending the 43rd Annual Convention of the Institution at Bangalore.

A reply has now been received from the Railway Board to the effect that rail concessions have not yet been restored and it would not be possible to grant concessions to persons attending the Convention. Attention of delegates is drawn to this notice.

Chairman of the Roads and Road Transportation Group

Consequent on the resignation of Shri H. P. Mathrani (*M.*) from the Chair of the Roads and Road Transportation Group, the President has appointed Shri S. R. Mehra (*M.*), Director, Central Road Research Institute, New Delhi, to the Chair of the Group for the remaining period of Shri Mathrani's term of office. Shri Mehra has accepted the Chair.

Programme of the Forty-Third Annual Convention, Bangalore, May 18-25, 1963

Further to the revised Programme of the Forty-Third Annual Convention printed in the February issue of the *Bulletin*, the following additional items may please be read along with the above Programme.

Programme for Monday. May 20, 1963

The Mysore Centre will give an At Home at 6.00 p.m. on Monday, May 20, 1963. With this addition, the programme for this day is repeated below.

9.00 a.m. to 1.00 p.m. (with Tea at 11.00 a.m.)	Address by Chairman and Symposia and Paper Meetings
1.00 p.m.	Lunch at the Pavilion adjacent to Rabindra Nataka Mandir
2.00 p.m. to 5.00 p.m.	Paper Meetings
6.00 p.m.	At Home by Mysore Centre
6.45 p.m. to 8.00 p.m.	Cultural Show at Rabindra Nataka Mandir

Paper Meetings in the Civil Engineering Division, May 20, 1963.

The Paper Meetings in this Division scheduled to be held from 9.00 a.m. to 1.00 p.m. (as in the Programme printed in the February *Bulletin*) will also be continued from 2.00 p.m. to 5.00 p.m. on May 20, 1963. The additional eight papers for discussion at these Paper Meetings are given below.

1. 'Reinforced Concrete Stack at Trombay—1. Investigations of Wind-Induced Vibrations : and 2. Construction' by S. Arunachala Reddi (*A.M.*) (*Journal*, vol. 42, no. 6, pt. CI 6, July 1962)
2. 'Foundations for Reciprocating Types of Machine' by H. A. Balakrishna Rao (*Non-member*) (*Journal*, vol. 42, no. 6, pt. CI 6, July 1962)
3. 'One-Dimensional Consolidation of Layered Soils' by A. Sridharan (*Non-member*) and T. S. Nagaraj (*Non-member*) (*Journal*, vol. 42, no. 6, pt. CI 6, July 1962)
4. 'Seismic Design of Earth Dams' by A. N. Harkauli (*A.M.*) (*Journal*, vol. 43, no. 3, pt. CI 2, November 1962)
5. 'Design of Trash Rack Structures' by M. Kothandaraman (*A.M.*) (*Journal*, vol. 43, no. 3, pt. CI 2, November 1962)
6. 'Design of Column Foundation' by A. S. Kenkare (*Non-member*) (*Journal*, (vol. 43, no. 5, pt. CI 3, January 1963)
7. 'Drag on a Hemispherical Element in Open Channel Flow' by A. G. Mirajgaokar (*Non-member*) (*Journal*, vol. 43, no. 5, pt. CI 3, January 1963)
8. 'Design of Anchored Bulkheads' by V. N. S. Murthy (*A.M.*) (*Journal*, vol. 43, no. 5, pt. CI 3, January 1963)

Symposium on 'Engineering Construction and Materials' in the Civil Engineering Division, May 21, 1963

The following papers will be presented at the Symposium.

1. 'Planning in Construction of Projects' by M. S. Deshmukh (*Non-member*)
2. 'Research in Materials and Construction' by M. K. Naidu (*Non-member*)
3. 'Use of Building Lime' by A. K. Bhowink (*A.M.*)
4. 'Planning in Construction Projects' by N. S. Bhat (*Non-member*)
5. 'Standardization in Building Construction' by A. Suryanarayana (*Non-member*)
6. 'Machines Used in Engineering Construction' by A. V. Keshava Rao (*Non-member*)
7. 'Methods of Executing Works' by Maj. R. S. Thakur (*Non-member*)
8. 'Role of Productivity in Construction' by P. P. Dharwadkar (*A.M.*)
9. 'Plastics in Buildings' by George Joseph (*Non-member*)
10. 'Scope of Plastics in Civil Engineering Construction' by Prof. M. V. Joshi (*A.M.*)
11. 'Sintering Fly Ash for Making a Light Weight Aggregate' by S. K. Chopra, (*Non-member*), C. S. Sharma (*Non-member*), and Krishan Lal (*Non-member*)
12. 'Ensuring Safety in the Construction of River Valley Projects' by Dr. K. C. Thomas (*M.*) and B. Sen (*A.M.*)
13. 'Methods of Improving the Efficiency in Construction Methods'. Y. L. Subramanyam (*Non-members*)
14. 'Construction Organization' by C. K. Chokshi (*M.*)
15. 'Methods of Improving Speed in Construction' by T. S. Mani (*Non-member*)
16. 'Planning in Construction of Projects' by K. N. Vyas (*Non-member*)

'Cost According in the Construction of River Valley Projects' by Dr. K. C. Thomas (*M.*) and N. Panchapakesan (*Non-member*).

Symposium on 'Some Aspects of Engineering Education' in the General Engineering Division on May 21, 1963

Besides the six papers already included in the Programme, two more papers to be presented at this Symposium are:

1. 'Training Engineers for the National Emergency' by Prof. N. S. Govinda Rao (*M.*)
2. 'Do We Need More Engineering Colleges' by D. G. Tamaskar (*A.M.*)

There will be a Meeting of Honorary Secretaries on May 22, 1963, at 3.00 p.m.

Refresher Courses in the University of Roorkee

For the benefit of serving engineers, the following Refresher Courses will be held at the University of Roorkee on the subjects given below during the period mentioned against each.

Subject	Period
Architecture and Town Planning ..	May 15-June 14, 1963
Civil Engineering consisting of Hydraulic Structures and River Training Works, Soil Mechanics and Drainage, Ground Water, Water Logging and Flood Control ..	May 3-August 2, 1963
Electrical Engineering consisting of Generation, Transmission and Transformation ..	May 1-July 31, 1963
Specialized Course on Design and Development in Machine Tools ..	April 14-May 10, 1963
Specialized Course on Erection, Commissioning and Maintenance of Hydro-Electric Power Stations ..	May 4-31, 1963
Specialized Course on Heat Treatment of Metals ..	June 2-28, 1963
Specialized Course on Theory of Vibration ..	July 1-28, 1963

Further details regarding the courses can be had from Shri B. D. Goyal (*M.*), Director, Refresher Courses, University of Roorkee, Roorkee.

FORTHCOMING CONFERENCES

Second IFAC Congress, Basle, August 27-September 4, 1963

The second Congress of the International Federation of Automatic Control will be held from August 27 to September 4, 1963, in Basle, Switzerland. The Swiss Association for Automatic Control will be the hosts on the occasion.

In June 1960, at the first IFAC Congress, more than 1,000 experts on automatic control gathered in Moscow. At the second IFAC Congress, the latest theories of higher automatics will be discussed and many sessions will be devoted to control devices and appliances considering the practical importance of automatic control.

A larger number of papers submitted for presentation at the Congress have been selected and reprints of these papers will be distributed to those who register in time. At the Congress, the authors will be allowed to present their papers in an abbreviated form only, and most of the available time will be devoted to free discussion. Each time four parallel sessions will take place, and plenary sessions are scheduled where review papers on various fields of automatic control will be presented by invited authors.

During the Congress, technical visits to institutes and industrial firms in Switzerland and adjoining countries are also planned. The International Exhibition of Industrial Electronics will be held from September 2-7, 1963, on the same premises as the Congress.

The official representative from India is Dr. Tribhuan Prasad, Bihar Institute of Technology, Sindri, Dhanbad. Those desirous of attending the congress will have to arrange for their finance, foreign exchange, etc. themselves. Completed registration forms routed through the Institution of Engineers (India), must reach the Congress Secretary in Zurich.

The Institution is a member Group of the International Federation of Automatic Control. Further details regarding the Congress can be obtained from the Headquarters Office of the Institution.

Conference on Dielectric and Insulating Materials, London, April 8-10, 1964

The Institution of Electrical Engineers, London, is arranging a three-day conference in London in April 1964 on the subject of the theory, properties, testing and uses of dielectric and insulating materials. The arrangments for the conference are being undertaken by the Institution's Science and General Division with the cooperation of the British Ceramic Society, the Institution of the Rubber Industry, the Plastics Institute, the Plastics and Polymer Group of the Society of the Chemical Industry, and the Society of Glass Technology.

The object of the conference is to discuss and record advances in the theory and practice of the subject since the last conference in 1953. The scope of the conference will include :

1. The theory of dielectric behaviour, in the stable condition and in the approach to breakdown ;
2. The range of materials available (solid, liquid or gaseous), and the choice of materials for particular applications ;
3. The properties and performance of dielectric and insulating materials at high or low voltages, direct or alternating of high or low frequencies; at high, normal or low temperatures, or, in unfavourable conditions through damp or corrosive environments or the presence of detrimental impurities or discharges ;
4. Methods of testing, properties and behaviour of insulating materials under any of the foregoing conditions ; and
5. The detection of faults and incipient failures

The organizing committee invites original formal papers of not more than 10,000 words for consideration for inclusion in the conference programme. The papers should be submitted in triplicate by November 30, 1963, and a summary of the proposed paper before April 30, 1963.

Further details concerning the programme of the conference and registration forms can be obtained from the Secretary of the Institution of Electrical Engineers, Savoy Place, London, W.C. 2.

BOOK ACKNOWLEDGMENTS

1. **Railway Track Connections (Points and Crossings).** K. F. Antia. *The New Book Company Private Ltd., Bombay*, Rs. 16.00. 210 pages.

Intended for the track specialist and the student of railway track connections, this book covers the theoretical as well as the practical aspects of the subject. In the presentation of the theory, higher mathematics has been avoided. Adequate consideration has been given to construction and maintenance of track connections, and yard layouts have also been briefly explained. Some standard dimensions applicable to India are given in the appendices.

2. **Specifications and Notes on Building Construction, Roads, Earthwork, etc.** S. K. Basu and A. K. Ray. *S. K. Lahiri & Co. (Private) Ltd., Calcutta*, Rs. 7.00. 292 pages.

The eleventh edition of this book intended for the use of students, builders and engineers has been revised to take account of the modern modes of construction.

3. **Logarithm, Steam, Steel and Other Tables.** K. P. Roy Chowdhury. Published by the author, 2/19, T. N. Chatterjee Street, Calcutta 50, Rs. 0.75 nP. 40 pages.

This compilation of useful tables is intended for students and engineers in every day work.

4. **Electrical Instruments and Measurements.** W. Alexander. *Claver-Hume Press Ltd.*, 25 s, *2nd edition*. 350 pages.

This revised version of this basic book is intended for those concerned with electricity, whether as technicians, instructors or students, and presents the essentials with only the most modest mathematics. The volume is illustrated with many diagrams, circuits, and photographs.

5. **Servicing Transistor Radios and Printed Circuits.** L. Lane. *Iliffe Books Ltd.*, 42 s. 264 pages.

The book aims to give, in the language of the practical man, a working knowledge of the theory of transistors covering practical applications and techniques. Printed circuits evaluated from the servicing standpoint and simple repairs to them are discussed. A servicing guide is included as a source of reference. The book is intended for the amateur, the apprentice and the technician.

6. **Ultrasonic Flaw Detection in Metals—Theory and Practice.** B. Banks, G. E. Oldfield and H. Rawding. *Iliffe Books Ltd.*, 63 s. 256 pages.

This treatise on an important branch of the science of non-destructive testing of components, equipments and structures is meant for use by engineers connected with quality production. Use of ultrasonics extends from the examination of materials before initial working to the subsequent periodic examination of components and strucures after installation in order to detect flaws caused by such factors as metal fatigue or irradiation. The treatment covers methods to make quality check on every piece part at any stage of manufacture, and the system can be adopted for continuous pen recording and automatic rejection of defective parts. The book also gives the test inspectorate a ready knowhow.

7. **Metallurgy in Nuclear Power Technology.** J. C. Wright. *Iliffe Books Ltd.*, 32 s. 6 d. 188 pages.

This volume presents a broad but compact survey of the metallurgy of special materials used in nuclear power technology to the non-specialist technical reader. It discusses the availability, production, fabrication and properties of fissible materials like uranium, plutonium and thorium, and their behaviour under irradiation. It also deals with the production of zirconium, beryllium and niobium; fuel canning materials; fuel element technology; and the effects of irradication on non-fissile metals. A chapter is also devoted to coolants and containment problems in reactors. Emphasis is laid on the importance of economics in nuclear power production.

8. **Cement Chemistry and Physics for Civil Engineers.** W. Czernin. *Crosby Lockwood & Son Ltd., London, S. W. 7.* 25 s. 139 pages.

The aim of this book is to present the complicated subject of cement chemistry in a summarized and intelligible form for the busy engineer and contractor. Many types of cement are described together with their properties and uses, and application and testing. The effects of water, climate and temperature and a variety of site conditions are discussed.

LIST OF NEW ELECTIONS AND TRANSFERS

(Continued from Bulletin for February 1965)

STUDENTS

No.	Name
35994	Kammasandram Narasimha Iyengar Srivatsa
35995	T. N. Shanmugasundaram
35996	Krishnamurty Vasudevamurty Nandagudi
35997	Makaram Narayan Rajagopal
35998	Hanumantharao Aswathanarayana
35999	Krishnaswamyiyer Lakshmipathy
36000	Hanagal Subbarao Srinivasa Rao
36001	Pavagada Ramarao Gopala Krishna
36002	Govindappa Narayanaiyer Krishna Iyer
36003	Alagawadi Gopinath
36004	Basappagouda Guralingappagouda Patil
36005	Gorur Narasimhachar Gopinath
36006	Bangalore Shamanna Satyan
36007	Channakeshavapur Subbarao Guru Raja
36008	Sankaranarayanan Ramaswami
36009	Nagappa Gurushiddappa Halemani
36010	Kadaba Padmarajan
36011	Munirathnamnaidu Krishna Raj
36012	Kadambi Sundarachar Shallappa
36013	Nalavalli Nanjundiah Narayana Swamy
36014	Neeragunda Ananthapadmanabha Rao
36015	Gurbax Singh
36016	Kesavamurthy Ananda Rao
36017	Mahadevaiah
36018	Shyama Narayana Rama Iyer
36019	Halsur Narasimhaiyengar Seshadri
36020	Shekharappa
36021	Gowda Srinivasaiah Somanathan
36022	Subramania Balakrishnan
36023	Salem Nanjundaiah Ganesh
36024	Madhukar Nanappa Piso
36025	Ram Shahani
36026	G. Rajarao Venkatesh
36027	Mavinakayihalli S. Gurunatha
36028	Mysore Sri Rama

STUDENTS (*contd.*)

No.	Name
36029	Bangalore Gundappa Balakrishna
36030	J. V. Somasekharaiah
36031	Syed Ishaq
36032	Kastur Narasimha Moorthy Seetharam
36033	Holavanahalli S. Ramaprasad
36034	Chaturvedi Vedamurthy Srinivasa Prasad
36035	Krishnamurti B. Mani
36036	S. Abdulgani Babalal Mulla
36037	Rajagopal Venkata Raghavan
36038	Rangaswami Balakrishnan
36039	Tumkur Gundurao Seshagiri
36040	Cpl. Karuna Shanker Misra
36041	Kandaswamy Sengodan
36042	Narayan Mahadeo Harshe
36043	Lokendra Nath Khanna
36045	Yelandur Shamarao Raja Rao
36046	Prabhakar Rajaram Abhyankar
36047	Surendra Shrikrishna Parulekar
36048	Ramesh Balkrishna Raikar
36049	Jadhav Viswanatharao Chandrasekhara Rao
36050	Lingappa Veerappa Jalihal
36051	Om Prakash
36052	Keralapur Narasimhaiyengar Bhagavan
36053	Parasuramam Sundara
36054	Seshan Srinivasan
36055	Devaraj
36056	Shashikant Balkrishna Supanekar
36057	Surinder Singh Kochar
36058	Ramachandra Shrinivas Gotur
36059	Karkada Yagnanarayana Sridhara
36060	Mysore Ramachandrasetty Gurumurthy
36061	Bangalore Ramappa Jayaram
36062	Belagode Krishnaiyengar Sreenivasan
36063	Abbigere Lingappa Chandra Sekhara
36064	Bharathur Sreenivasaiyengar Satya Prasad
36065	Karalapur Rameswamyiyyengar Gopalan
36066	Kolar Sundareshan
36067	Georgenedumparambil Abraham
36068	Panduranga Shanbhogue
36069	Mutharaj Theodore Solomon Raj
36070	Venkatachalaiah Dinamani
36071	Belur Nanjundiah Jagadeesha Prasad
36072	Mysore Srikantapandit Jagadisha Babu
36073	Karamatti Sampathkumaran Tharanathan
36074	Chichurkanahalli Seshadri Srinivasan
36075	Dhanaraj Benedict Selvaraj
36076	Bangalore Madhvarayachar Ramesh
36077	Vitlapur Sreekantavadhani Subramanyam
36078	Srinivasa Ramaswamy
36079	Bangalore Ramaseshaiah Subramanya
36080	Narasimhachar Srinivasavaradachar Dore
36081	Nallam Chakravarthi Nandakumar
36082	Channagir Gopala Krishna Setty
36083	Thirumale Venkatarangachar Srinivasarangachar
36084	Nelamangala Prabhakara
36085	Mruthika Srinivashamurti Nagaraja
36086	Honnavalli Suryanarayanarao Manjunatha
36087	Tirumalai Srinivasachar Parthasarathy
36088	Tirumale Ramachar Prakash
36089	G. Subrahmanya Sastry
36090	Doddachowdaiah
36091	Kittankere Srinivasaiah Krishna Murthy
36092	Jagjit Singh
36093	Mylandahalli Vasudevaiah Seethapathy
36094	Laymi Narain
36095	Srinivasan Natarajan
36096	Pyati Sreenivasa Murthy
36097	Ravindra Nath Garg
36098	Jom Nangachiveettil Joseph Thommi
36099	H. Nagakumaraiah Santha Rajaiah
36100	Sorab Keshavamurthy Krishnamurthy
36101	Dalbir Singh
36102	U. Subramanya Navada
36103	Paramjit Singh
36104	Basappa Basappa Uppin
36105	N. R. Anantha Ramu
36106	Inder Mohan Goswami
36107	Ramakrishnapillai Parameswaran Nair
36108	Ram Chand Jethanand Panjwani
36109	Rajendra Kumar Jain
36110	Maharaj Krishen Zutshoo
36111	Raghavendra Shriniwas Nirji
36112	Kuldip Raj Marwaha
36113	Gian Chand Garg
36114	Sudarshan Kumar Khosla
36115	Balvir Raj Gupta
36116	Mansa Ram Dahiya
36117	Krishan Parshad
36118	Paramjeet Singh

STUDENTS (*contd.*)

No.	Name
36119	Jagadish Chand Gupta
36120	Halidipur Purusiah Vasudeva Rao
36121	Jagmohan Singh
36122	Nandalal Chhabra
36123	Parmjit Singh Mherm
36124	K. R. Venkataramani
36125	Jagadish Chander
36126	Kailash Chandra Agrawal
36127	Bhupinder Kumar Seghal
36128	Manjit Singh Panesar
36129	Chiranjive Lal
36130	Koratpekere Narayana
36131	Bal Krishan Saini
36132	Surinder Singh Rehill
36133	Roshan Lal Justa
36134	Peddinti Abdul Shukur
36135	Mandayam Chakravarti Venkatarangan
36136	Nanjundappa Seetharama
36137	Ramaswamy Narasinha Murthy
36138	Bijady Venkatachala
36139	T. M. Alagirisamy Nagalingam
36140	Shyamaleshwar Roy Chowdhury
36141	Bangalore Seshaiah Sudarshan
36142	Gundappa Rangaramaiah
36143	Shrichand Singhal
36144	Narinder Singh Mangat
36145	Shiv Sharma Prabhakar
36146	Manohar Lal Sharma
36147	Dhara Dev Chaudhry
36148	Satya Paul Sharma
36149	Madangopal C. Nalinaksha Kumar
36150	Tatavarty Venkata Bapiraj
36151	Gopalakrishnan Jayaraman
36152	Vishwa Nath Singh Gaharwar
36153	Baldev Raj Sehgal
36154	Kewal Singh
36155	Balwant Singh Gaur
36156	Sita Ram Varshney
36157	Sarvan Kumar Nangia
36158	Sagri Laxminarayana Acharya
36159	Navinchandra Nanalal Trivedi
36160	Jayanta Kumar Nandi
36161	Laxmikant Harsutrai Buch
36162	Prabhu Nath Prasad
36163	Parshuram Dwarkadas Vaishnav
36164	P. Mallikarjunaiah Viswanthaiah
36165	H. Siddalingappa Ramachandrappa
36166	Surjit Singh Bharij
36167	Om Parkash Kalra
36168	Mahesh Ratanlal Desai
36169	Gulshan Rai Mehta
36170	Lakhi Pribhdas Jaisinghani
36171	Pulakananda Baksi
36172	Narayan Dayaram Wadhwani
36173	Chandrakant Dalichand Mehta
36174	Sankaranarayananiyer Srinivasan
36175	Gour Mohan Dey
36176	Dev Dutt Verma
36177	Krishan Lall Batra
36178	Pravinchandra Bhailal Mehta
36179	Kishorekumar Naraharishankar Thakore
36180	Jagannathan Govind
36181	Kiritkumar Haribhai Patel
36182	Bindubhushan Roy
36183	Jiban Kumar Mukherjee
36184	Saibal Gupta
36185	Dayanand Shrivastava
36186	Dilip Kumar Banerjee
36187	Ratan Kumar Bandyopadhyay
36188	Debendra Nath Chattopadhyay
36189	Dhirendranath Bhattacharyya
36190	Subir Kumar Majumder
36191	Cpl. Andhiyur Raju Maniam
36192	Sureshchandra Gendalal Talati
36193	Ajoy Kumar Gupta
36194	Dhirendranath Sarkar
36195	Kripa Sindu Sinha
36196	Ashimabha Bhattacharyya
36197	Singam Venkata Subba Reddy
36198	Shyamal Chowdhury
36199	Mrinal Kanti Chanda
36200	Bhupal Chandra Sensarma
36201	Sanjit Kumar De
36202	Ananda Mohan Das
36203	Sambhu Nath Ganguly
36204	Brij Mohan Lal
36205	Subramanian Krishnan
36206	Bhadresh Keshavprasad Shah
36207	Bisweswar Ghosh
36208	Suresh Anantacharya Shirgur

STUDENTS (*contd.*)

No.	Name
36209	Sushil Ranjan Roy
36210	Mrinal Kanti Mandal
36211	Nirmal Ranjan Chakladar
36212	Byomkesh Guha Niyogi
36213	Hari Narayan Bagchi
36214	Animesh Chowdhury
36215	Amiya Prakash Ghosh
36216	Bahnu Bhusan Dutta
36217	Dipendu Krishna Roy Chowdhury
36218	Prakash Kumar Chandra
36219	Rabindra Mohan Chakrabarti
36220	Mani Mohan Prasad
36221	Jadish Mitter
36222	Sgt. Karuvellil Pothen Verghese
36223	Panna Lal Nag
36224	Debes Kumar Bhattacharyya
36225	Jyotirmoy Banerjee
36226	Ananthanarayana Gopalakrishna Iyer
36227	Kanji Ratanshi Tataria
36228	Promod Chandra Sinha
36229	Soumendra Chakraborty
36230	Ranjit Kumar Khasnovis
36231	Achin Kumar Basu
36232	Abani Bhusan Choudhuri
36233	Subal Kumar Biswas
36234	Braham Datt Gupta
36235	Gomanbhai Khushalbhai Patel
36236	Devarkkonda Venkata Rama Sarma
36237	Gurudas Adhya
36238	Harasankar Biswas
36239	Kalpathy Suryanarayanaiyer Ganeshan
36240	Kajal Baran Das Gupta
36241	Kalyan Kumar Sanyal
36242	Samar Sen
36243	Arun Kumar Adak
36244	Arun Kumar Jana
36245	Kamru Zaman
36246	Satya Ranjan Misra
36247	Manimoy Bhowmich
36248	Ramendra Mohan Roy Ghatak
36249	Ashoke Kumar Chakraborty
36250	Amarendra Lal Sarkar
36251	Pradip Kumar Sarkar
36252	Utpal Sengupta
36253	Krishnaayyar Rameswamy
36254	Tarak Chandra Das
36255	Gopi Karmakar
36256	Tapaneswar Chaudhuri
36257	Jyotirmoy Basu Ray
36258	Amar Nath Chattopadhyay
36259	Dipak Kumar Ray
36260	Dilip Kumar Gangopadhyay
36261	Bibhuti Bhushan Patra
36262	Bijoy Kumar Jhunjhunwala
36263	Chandidas Hewli
36264	Dhrubamohan Pakrashi
36265	Supati Charan Bandyopadhyay
36266	Nirmalendu Chakraborty
36267	Khagendra Nath Biswas
36268	Denzil Edward Bruce
36269	Debasis Sarkar
36270	Nagampalli Venkatramayya
36271	Sisir Kumar Chatterjee
36272	Shamsherjohn Chandu Lal
36273	Amulya Chandra Modak
36274	Jagjit Singh Mann
36275	Madan Mohan Nath
36276	Ishwarlal Dovjibhai Patel
36277	Prabhatranjan Datta
36278	Dilip Kumar Chattopadhyay
36279	Gouri Sankar Bandyopadhyay
36280	Kumkulagunta Sambasiva Prasad
36281	Santosh Chakraborty
36282	Rameshwar Prasad
36283	Guru Das Pandey
36284	Sushil Ray
36285	Ranendra Chandra Pal
36286	Narayan Chandra Majumdar
36287	Madhu Sudan Pal
36288	Narayan Chandra Das
36289	Anil Kanti Banik Choudhury
36290	Nand Kishore Pandey
36291	Arup Kumar Barman
36292	Soumyendra Mohan Chatterjee
36293	Samir Kumar Ghosh
36294	Jyotish Chandra Ghosh
36295	Anil Chandra Chattopadhyay
36296	Amir Alam Khan
36297	Nanda Dulal Choudhury
36298	Sailendra Nath Gangopadhyay

STUDENTS (*contd.*)

No.	Name
36299	Mandhata Ojha
36300	Champaklal Ranchhoddas Gajjar
36301	Kanubhai Vadilal Sheth
36302	Ved Prakash Jain
36303	Basudeb Panda
36304	Prabhu Nath Singh
36305	Jag Prasad Pandey
36306	Dilip Kumar Sengupta
36307	Sachchida Nand Singh
36308	Jethabhai Chandulal Shah
36309	Surendra Kallappa Bendigeri
36310	Parmeshwar Sinha
36311	Bhabani Prosad Dalal
36312	Pashupati Nath Sinha
36313	Vinodray Gunvantray Parikh
36314	Deo Sharma Kaushik
36315	Gour Chandra Mukhopadhyay
36316	Tapeshwar Singh
36317	Md. Ozair Ansari
36318	Harihar Ram
36319	Gordhanbhai Shankerbhai Patel
36320	Basudeo Prasad Pathak
36321	Laxman Nebraj Thakur
36322	Baidya Nath Pathak
36323	Sanat Kumar Chowdhury
36324	Ramesh Narayan Hichkad
36325	Ramanbhai Somabhai Patel
36326	Arvind Haribhai Naik
36327	Hemantkumar Dahyabhai Vyas
36328	Gunakar Mishra
36329	Bhagvanji Dhanraj Padalia
36330	Rameshchandra Vrajlal Bhimani
36331	Harish Chandra Prasad
36332	Shyam Sunder Lal
36333	Brahmadeo Chaudhary
36334	Arun Kumar Sinha
36335	Ghasi Ram
36336	Nand Bhushan Prasad Roy
36337	Bali Ram Singh
36338	Anandshankar Ganpatram Joshi
36339	Pravinchandra Manilal Shah
36340	Sureshchandra Chamanalal Dave
36341	Uday Nath Jha
36342	Sunil Kumar
36343	Nirmal Kumar Ray
36344	Nagasundaram Viswanathan
36345	Hasan Imam
36346	Mahatma Prasad Pandey
36347	T. S. Subramanian
36348	Abhram Nanji Patel
36349	Ram Pamandas Lala
36350	Subhas Chandra Dey
36351	Arun Kumar Ghosh
36352	Bhupendrakumar Hiralal Pandya
36353	Yogendra Prasad Chaudhary
36354	Badri Narayan
36355	Janak Kishore Prasad
36356	Akhilesh Kumar Sinha
36357	Rameshchandra Raghnathji Naik
36358	P. R. Sankaranarayanan
36359	Sheo Sharan Singh
36360	Ramchandra Pralhad Dawalkar
36361	Hosagrahara Ramarao Bhaskar
36362	Lac Chudaman Hari Chaudhari
36363	Hari Gopal Maheshwari
36364	Narinder Singh Sodhi
36365	Rajagopalan Ramamoorthy
36366	Cpl. Yagya Datt Mehta
36367	Cpl. Nidathavolu Jagga Rao
36368	Shrikrishna Vyankatesh Sontakke
36369	Cpl. Gurcharan Lal Kohli
36370	Kilithattil Mathew George
36371	Shivarudrappa
36372	Venkatarayachar Nagarajan
36373	Subramanyamchetty Kuppaiah Chetty
36374	Lac Mohanlal Rajaram Rajput
36375	Jagdish Chandra Pal
36376	Sundararaj David
36377	Madhugir Sethurao Madhwesh
36378	Raghuraj Behari Mathur
36379	Raj Behari Lal
36380	Ramesh Chander Handa
36381	T. Jagannath Balasubramaniam
36382	Mohan Pribhdas Tulsani
36383	Brij Mohanvag
36384	Uma Sankar
36385	Shunmugaperumal Saravanabavan
36386	Vasudeva Narasimhan
36387	Jayashankara Rao
36388	Ranjit Singh Garha

STUDENTS (*contd.*)

No.	Name
36389	Maya Nath Rai
36390	Ratan Kumar Shivnani
36391	Chandra Prakash Beotra
36392	Robin Andrews
36393	Cpl. C. Manickannair Sanku Menon
36394	Tushar Kanti Roy
36395	Om Parkash Bhandari
36396	Mahendra Singh
36397	Pravin Chandra Narmadashanker Bhatt
36398	Kodandapaniiyer Venkataraman
36399	Ashok Bhagia
36400	K. Seetharamasetty Pujyaprasad
36401	Hardial Singh Sokhon
36402	Kailash Prasad Singh
36403	Sushil Chandra Bhatia
36404	B. Srikantappa Nagaraja
36405	Pratap Bhojraj Tulsiani
36406	Tusharkanti Chakrabarti
36407	Subramaniam Vankat Ramani
36408	Hari Narayan Kar
36409	Manmohanlal Bhai
36410	Kirpa Singh
36411	Ram Janma Singh
36412	Madhusudhan Ramcharan Nashine
36413	Dharam Pal Singh
36414	Ram Swaroop Khabani
36415	Rameshwar Goldsmith
36416	Madhusudan Mohanty
36417	Suresh Chander Tanwar
36418	Sikander Lal Chhokra
36419	Mahendra Kumar Chunilal Parekh
36420	Gurbakhsh Singh Pasricha
36421	Gurbakhsh Singh
36422	Jagdish Chandra
36423	Kailash Chandra Sharma
36424	Vishnu Dattatraya Kulkarni
36425	Sukumar Ghosh
36426	Harbans Singh Ahuja
36427	Madan Lal Doda
36428	Hariprasad Motilal Marwadi
36429	Maharaj Kishen Kachru
36430	Hardyal Singh Guraya
36431	Suresh Kashinath Deshpande
36432	Tharavanat Arun Kumar
36433	Vaidya Shankar Atree
36434	Eledath Gopinathan
36435	Abdul Hai Mohammed Omer Khan
36436	Minoo Jamshed Irani
36437	Balkrishna Digambar Atre
36438	Ramchandra Narayan Manohar
36439	A. Ninan Kuruvilla
36440	Aroon Ganesh Sathe
36441	Vidyadhar Digambar Gokhale
36442	Sultan Bashir Nabilal Mulla
36443	Arun Viswanath Dighe
36444	Raghunath Dnyandeo Desai
36445	Khagendra Nath Rudra
36446	Dilip Balvant Apte
36447	Fg.-Off. Amal Shankar Ray
36448	Kodavasal Seranathan Ramaswamy
36449	Dattatray Laxman Kapaleshwari
36450	Mukund Hari Deshpande
36451	Anil Chunilal Sheth
36452	Madhav Krishnarao Mahe
36453	Suresh Dattatraya Bhagwat
36454	Bharadwaj Krishnaiyengar Mandyam
36455	Balgonda Anna Patil
36456	Ramchandra Haramb Karmarkar
36457	Ashok Kumar Proothi
36458	Polad Ardeshir Irani
36459	Kaliyur Rangasastry Chandrashekar
36460	Jatinder Kumar Bhatia
36461	Mohan Baburao Patwardhan
36462	Ramchandra Krishnarao Mudukshivale
36463	Narender Kishinchand Makhijani
36464	Manohar Shantaram Shinde
36465	Seethanady Devadas Nayak
36466	Thota Venkateswararao
36467	Sadanand Trimbak Phanse
36468	Ashok Sitaram Joshi
36469	Vasant Vithal Paliwal
36470	David Mathew
36471	Manohar Khemchand Keswani
36472	Hargobind Jagasia
36473	Allarakhu Kasambhai Vankalwala
36474	Chiriyankandath Chummar Michael
36475	Arvind Shamrao Salukhe
36476	Asim Kumar Ghosh
36477	Maligaimedu Srinivasan Govindarajan
36478	Vijay Madhaorao Kontamwar

STUDENTS (*contd.*)

No.	Name	No.	Name
36479	Rameshchandra Mathuradas Asher	36524	Birendranath Sankhari
36480	C. Lakshmanaiyer Suryanarayanan	36525	Manohar Govind Marathe
36481	Shriram Dattatraya Barve	36526	Kamlakar Ramkrishna Kulkarni
36482	Pratapsingh Appasaheb Jagtap	36527	Kyathanahally Nanjappa Nanjundaswamy
36483	Sarjit Lal	36528	Satyendra Kumar Sinha
36484	Janardan Das	36529	Hajisaheb Husensaheb Nadaf
36485	Katticaren Joseph George	36530	Harbans Lal
36486	Shashikant Rangnath Raverkar	36531	Madisetty Karibasappa
36487	Inder Mohan Sharma	36532	Girish Kashinath Pathak
36488	Norman D. Souza	36533	Kallery Porinchu Chakkoru
36489	Poomarathil Gopalakrishnan	36534	Lac M. C. Sreedharan Nair
36490	Santosh Kumar Das	36535	Arunkant Ramalingappa Bhupali
36491	Mannanikattu Thomas Mani	36536	Suresh Sheshagiri Kurdekar
36492	Mohan Dattatreya Karmarkar	36537	Bhupinder Singh
36493	Dagadu Taniram Wani	36538	Banwari Lal Sharma
36494	Norman Anthony Mascarenhas	36539	Virendra Paul Joshi
36495	Jagjit Singh Kharah	36540	Chandrakant Mahadeo Umarani
36496	Anil Shankar Gupta	36541	Prabhakar Narayan Muley
36497	Mahalingasastry Rangarajan	36542	Jem. P. U. Anandakrishnan
36498	D. Louis John Joseph	36543	Suhas Vaman Jangi
36499	Bhimsain Narayan Virmani	36544	Ramesh Chander Jain
36500	Bhagat Ram	36545	Kishan Suka Dhande
36501	Tiruvenkadu Rajam Venkata Raman	36546	Cpl. Mangipudi Venkateshwara Rao
36502	Achanna Gundappa	36547	Shamu Dasho Agnihotri
36503	P. Narayanaiyer Subramanian	36548	Vishwa Nath Singh
36504	Sharadchandra Divakarappa Sulebhavi	36549	Manik Madhukar Patkar
36505	Ganesh Das Gulati	36550	Viswanath Krishnamurthy
36506	Natesa Ramasubramanian	36551	T. P. S. Narayanan Nair
36507	Kashinath Raghunath Jadhav	36552	Pritam Singh
36508	Shrikrishna Vishnu Paranjpe	36553	Jagan Nath
36509	Jagdish Chandra Sharma	36554	Romesh Chand Goyal
36510	Pradum Vasudeo Dabholkar	36555	Wali Mohammad Khan
36511	Prabhakar Vinayak Eksambekar	36556	Ramesh Chandra Gupta
36512	Popat Murlidhar Sawant	36557	Bhag Singh Premi
36513	Krantideo Nawal	36558	Gurcharan Singh
36514	Flt. Sgt. Udo Singh	36559	Kothandaraman Anantharaman
36515	L. Ramaiyer Subramanian	36560	Pothuvaya Manakkil Chithrabhanu
36516	Keshav Bapurao Mahajan	36561	Somnath Motiram Luthra
36517	Raghunath Laxman Deshpande	36562	Kulwant Singh
36518	Krishna Balkrishna Joshi	36563	Bakshish Singh
36519	Sherbet Venugopala Rao	36564	Shrikrishna Keshav Soman
36520	Suresh Dinkar Kulkarni	36565	Shiv Ratan Maheshwari
36521	Inder Singh	36566	Bachan Lal
36522	Gul Bijlani	36567	Brahma Swarup Shukla
36523	P. Narashimhachar Thirunarayana	36568	Asthbhuja Saran

STUDENTS (*contd.*)

No.	Name	No.	Name
36569	Surriendar Kumar	36614	Jagdish Chand Bindle
36570	Madan Mohan Nanda	36615	Naidu Bangar Logaraj
36571	Surendra Prakash Sharma	36616	Balwant Singh Sharma
36572	Sachindranath Das	36617	Narasimha Sharadamohan Punekar
36573	Surendra Kumar	36618	Champalal Motilal Gandhi
36574	Ponnulinga Nadarajan	36619	Chandrakant Shankar Shukla
36575	Ved Prakash Sareen	36620	Inder Deo Joshi
36576	Jatinder Pal Sood	36621	Satendra Kumar Jain
36577	Satish Kumar Talwar	36622	Sayeed Ahmad
36578	Narpal Singh Kanwar	36623	Manohar Lal Kapur
36579	Madan Lal	36624	Sunil Kumar Dasbiswas
36580	Puran Chand Jhingan	36625	Harish Pershad Saksena
36581	Abbayareddi Jayaraman	36626	Ravinder Lal
36582	Raj Kumar Dhawan	36627	Plathanathu Verghese Jacob
36583	Amar Nath	36628	Satya Dev Chawla
36584	Palanisamy Thiruvengadam	36629	Harbans Lal Marwaha
36585	Ravi Bhushan	36630	Braj Nandan Shukla
36586	Avtar Singh Mann	36631	Tarlochan Singh
36587	Bhanuprasad Indulal Sheth	36632	Bhola Nath
36588	B. Kishore	36633	Arekere Sanjiva
36589	Narendra Kumar Anand	36634	Varadraj Narayan Ayangar
36590	Sudesh Kumar Anand	36635	Gopal Ramchand Choithramani
36591	Mohan Balkrishna Govande	36636	Lal Rahandomal Lachhwani
36592	Rajendra Singh	36637	Devi Singh Nandal
36593	Jagdish Prasad Shukla	36638	Cheruthodiyil Balagopalan Unni
36594	Jagdish Chandra Nakra	36639	Prem Shankar Srivastava
36595	Bal Govind	36640	Tersame Dass
36596	Satish Kumar Chawla	36641	Muni Lal
36597	Surrendra Mohan Dhir	36642	Peshotan Dhunjishaw Mehta
36598	Jagdish Ram	36643	Vedurumudy Lakshmi Narasimha Rao
36599	Romesh Chander Gupta	36644	Ram Kishore Valecha
36600	Bal Krishan Soni	36645	Ramchand Ajwani
36601	Rameshwar Dass Gupta	36646	Lurind Chand
36602	Darshan Singh Dhillon	36647	Nirmal Singh
36603	Bachan Lal	36648	Vasupanicker Aravindakshan
36604	Chaman Lal Rahmila	36649	Thakar Singh
36605	Santosh Kumar	36650	Ramesh Purushottam Kamath
36606	Daya Shanker Rai	36651	Kishorchandra Vallabhbhai Panchal
36607	Jyoti Saroop	36652	V. Samuel Varkey
36608	Nand Lal Dumbra	36653	Shiv Dyal Kataria
36609	Raj Kumar Tandon	36654	Govindapillay Ramchandran Pillay
36610	Om Prakash Bhatia	36655	Prosanta Kumar Goswami
36611	Surrinder Kumar Murwaha	36656	Binay Krishna Bandyopadhyay
36612	Gollapudy Ramesh	36657	Akshantala Venkata Karthikeya
36613	Annasaheb Baswantrao Shinde	36658	Naresh Chandra Baruah

STUDENTS (*contd.*)

No.	Name
36659	Aacharya Lal
36660	Prakash Singh Chhabra
36661	Vidyadhar Vasudeo Joshi
36662	Nandakumar Vishwanathrao Tiwaskar
36663	Gopal Krishna Saxena
36664	Raj Deo Pandeya
36665	Binod Chandra De
36666	Rajendra Krishna Saksena
36667	Amar Kumar Bandyopadhyay
36668	Naipal Singh Tomar
36669	Puran Mal
36670	Ghan Shyam
36671	Hari Om Ahuja
36672	Ram Singh
36673	Bibhuti Bhattacharjee
36674	Gulam Mohiuddin Abdul Razak Shaikh
36675	Krishna Chandra Agrawal
36676	Nettimi Rama Murty
36677	Shubhendu Sen Gupta
36678	Asok Kumar Sen
36679	Bhagwan Bulchand Jhangiani
36680	Dwizendra Lal Chakraborty
36681	Saktinath Chatterjee
36682	Dilip Kumar Bhattacharya
36683	Tarit Kumar Mondal
36684	Dinesh Kumar Bandyopadhyay
36685	Kiranmay Lahiri
36686	Pranab Kumar Basu
36687	Pranabkumar Rudra
36688	Sati Prasad Goswami
36689	Prabhas Kanti Pal
36690	Umashankar Gangopadhyay
36691	Malay Kumar Barua
36692	Kalidas Banerjee
36693	Nagendra Prasad Singh
36694	Dilip Kumar Pain
36695	Chandra Nath Chattopadhyaya
36696	Ashoke Kumar Ghosh
36697	Priya Ranjan Sen
36698	Srikumar Roy Chowdhury
36699	Somnath Bandyopadhyay
36700	Satyabrata Dass
36701	Himangshu Sekhar Jana
36702	Ajay Kumar Bandyopadhyay
36703	Sarojranjan Bhar
36704	Anilbaran Chaudhuri
36705	Satya Priya Ghosh Dastidar
36706	Asokkumar Mitra
36707	Sambhu Charan Singha
36708	Biswoswar Adak
36709	Manjul Prokash Bandyopadhyay
36710	Suranjan Dey
36711	Balai Kumar Nandi
36712	Sourendra Nath Ghosh
36713	Lakhan Chandra Chakraborty
36714	Rabindranath Basu
36715	Stephen Joseph
36716	Byomekesh Bose
36717	Chandra Kumar Sarma
36718	Bibhuti Bhusan Paul
36719	K. Hariharan Raman
36720	Amit Nath Mukhopadhyay
36721	Ashes Ray Chaudhury
36722	Sambhunath Haldar
36723	Jainti Prashad Rustagi
36724	Balbir Singh Virdi
36725	Subimal Kumar Chatterjee
36726	Harcharan Singh Sisodia
36727	Baldev Singh
36728	Charan Dass Bhargava
36729	Jawahar Lal Sharma
36730	Jagdishwar Narayan Wadhonkar
36731	Yogesh Kumar Sharma
36732	Subhash Chander
36733	Prem Prakash Dhingra
36734	Nihar Ranjan Bhattacharya
36735	Bhim Sain Chaudhri
36736	Om Prakash Jhamb
36737	Satish Chandra Gupta
36738	Mohan Lal Mehra
36739	Mahendrakumar Chatrabhuj Gajaria
36740	Suresh Chander Madan
36741	Nalinkumar Ochhavalal Parikh
36742	Venkitachalaiyer Balakrishnan
36743	Kantilal Vallabhdas Parekh
36744	Kishore Tarachand Ajmera
36745	Anant Ramchandra Amle
36746	Priyaranjan Chaudhuri
36747	Shakir Fidahusain Pardawala
36748	Ved Prakash Kohli

STUDENTS (*contd.*)

No.	Name
36749	Arun Kumar Pandya
36750	Dharam Pal Singhal
36751	Chatru Jiandani
36752	Mahavir Keshavrao Bitode
36753	Moiz Ishaquebhai Ansari
36754	Sankar Nath Chakrabarti
36755	Dinesh K. Hattangadi
36756	Ramesh Chandra Sharma
36757	Anand Pribudas Vazirani
36758	Prem Nath Kapur
36759	Abnash Singh Babra
36760	Vijay Navalmal Bhandari
36761	Kamal Kishore Sachar
36762	Ram Kishore Gupta
36763	Ashok Kumar
36764	Khalilullah Khan
36765	Harkiran Singh Ahluwalia
36766	Ramchandra Hanumantarao Kulkarni
36767	Amitava Sen
36768	Asit Kumar Chattopadhyaya
36769	Laxman Ganesh Shendee
36770	Umesh Chandra Sharma
36771	Yashwant Ganesh Bhide
36772	Sumantbhai Manibhai Patel
36773	Vijay Prasad Sinha
36774	Krishan Kumar Lal
36775	Harbans Lall Kapoor
36776	Prabhakar Shankar Kale
36777	Shiam Lal
36778	Vinay Kumar
36779	Vijay Kumar
36780	Arvind Hari Paranjape
36781	Rameshwar Raj
36782	Keshav Chandra Naithani
36783	Budh Dev
36784	Shiv Kumar Garg
36785	Ramesh Chander
36786	Anand Shantaram More
36787	Bhagwan Singh
36788	Ramrao Vishnu Jadhav
36789	Hans Raj
36790	Ahmad Sayeed
36791	Ram Autar
36792	Kalyan Singh Kumpawat
36793	Anil Kumar Bohra
36794	Prem Kumar
36795	Krishan Baldev Gosain
36796	Mohinder Paul Bhalla
36797	Param Jeet Singh
36798	Shrikant Sadashiv Chitari
36799	Shiv Shanker Agrawal
36800	Ram Prakash Agarwal
36801	Iqbal Ahmed Gulam Nabi Dukdule
36802	Rattan Kumar Gupta
36803	Vijay Datt Bharadwaj
36804	Ram Ratan Gupta
36805	Sobho Sangtani
36806	Vinayak Shankarrao Phadke
36807	Kewal Krishan Sarin
36808	Vijay Kumar Nanda
36809	Sushilkumar Janardan Sahasrabudhe
36810	Vijaya Pal Singh
36811	Kamal Kanti Gupta
36812	Kanhaiya Lal Kothari
36813	Amrish Kumar Goel
36814	Ananthu Narayanan Iyer
36815	Jagdish Singh Virdi
36816	Arjun Singh Khandka
36817	Sharadkumar Narayan Rao Bhandakkar
36818	Yashwant Nilkant Subhedar
36819	Yudhishter Taneja
36820	Keki Minocher Patel
36821	Ram Krishna Gupta
36822	Chaman Lal Anand
36823	M. Narayanaiyer Raman
36824	Shrikrishna Laxmanrao Kolhapure
36825	Suhas Shantaram Kulkarni
36826	Chandra Prakash Saxena
36827	Ramchandra Keshav Kulkarni
36828	Nirmal Kumar
36829	Radhey Shyam Naik
36830	Jagdish Chandra Lathey
36831	Naresh Chandra
36832	Hari Ram
36833	Anand Swarup Kaushik
36834	Satish Chandra Chopra
36835	Kishore Madhaorao Ghanote
36836	Karathuparambil Krishnankutty Vasu
36837	Dharam Pal Puri
36838	Raghavanpillai Gopimohan Nair

STUDENTS (*contd.*)

No.	Name
36839	Brajeshwar Dayal
36840	Mayinakaihalli Vyasarao Sripada
36841	Shriram Devendra Shanbhag
36842	Amar Nath Ram
36843	Surat Singh
36844	Govind Saran Srivastava
36845	Belka Rama Mayya
36846	Naresh Chandra Goel
36847	Raj Kumar Jain
36848	Vital Nooyi Bhat
36849	Surinder Kumar Khanna
36850	Harbans Singh Sohal
36851	Cpl. Anupam Bagchi
36852	Harish Chandra Gupta
36853	Arun Kumar Mukherjee
36854	Himanshu Mohan Baranwal
36855	Prem Bahadur Saxena
36856	Harisingh Neumal Gabra
36857	Narayan Shivaramji Harne
36858	Prem Kumar Jettley
36859	Syed Shah Asgar Hussaini
36860	Surakant Gopal Chaudhari
36861	Ashok Dinkarrao Deo
36862	Ramesh Shankar Khanvilkar
36863	Nandakumar Narayan Dandekar
36864	Surampudi Satyanarayana Murty
36865	Jamini Kanta Sarmah
36866	Beena Thomas
36867	Vishan Das Jogiani
36868	Dattatraya Gopalrao Porlikar
36869	Dinkar Waman Zope
36870	Harihar Nath Misra
36871	Ram Kumar Gupta
36872	Nataraja Pillay Dhas
36873	Jyoti Bikash Bose
36874	Ram Parikshan Sinha Pankaj
36875	Rajendra Singh Chadha
36876	P. K. Rmachandran Nair
36877	Hari Narayan Shivapuri
36878	Ashok Shrirang Meghre
36879	Hari Om Prasad Srivastava
36880	Uday Bhan Singh Bhadauria
36881	Ramesh Chandra Srivastava
36882	Murlidhar Gundopant Kulkarni
36883	Chandrakant Bapusaheb Gaikwad
36884	Tanjore Subramaniam Viswanathan
36885	Jashawant Shantilal Trivedi
36886	Narendra Singh
36887	Devendra Singh Tayal
36888	Ashok Kumar
36889	Ethilkandy Radhakrishnan
36890	Satish Chand Jain
36891	Jagdish Kumar Malhotra
36892	Amrit Pal Arora
36893	Subhas Chandra Gandhi
36894	Sudhakar Anandrao Primpalgaonkar
36895	Uttamrao Ganpatrao Pawar
36896	Madhukar Chintamanrao Bhave
36897	Gur Gian Singh Birdie
36898	Rattan Lal
36899	Shankar Saran Dubey
36900	Jagdish Chand Gaur
36901	Suryakant Govindrao Deshpande
36902	Bolindra Nath Chutia
36903	Brij Mohan Tuli
36904	Raj Kumar Khanna
36905	Rachhpal Singh
36906	Bhaskerrai Jagmohandas Parekh
36907	Vinod Behari Lal Mathur
36908	Ghanshyam Moolchand Tolani
36909	Pradyumn Dubey
36910	Ghanshyam Dass
36911	Yadubansh Kishore Darbari
36912	Shiva Shankar Bhargava
36913	Prem Kishore Agarwal
36914	Nandgopal Shriniwas Mudliar
36915	Bhanudas Dattatraya Dahale
36916	Krishna Mohan Sinha
36917	Iqbal Singh Dadiala
36918	Mysore Srinivasarao Raghunandan
36919	Ravindra Laxmikant Deshpande
36920	Nagavar Shamarao Ramachandra Rao
36921	Arvind Purshottam Pagay
36922	Sham Lal
36923	Jayant Vinayak Phatak
36924	Suresh Murlidhar Chipalkatti
36925	Avinash Chandra Mital
36926	Varughese Chacko
36927	K. Kuriakose George
36928	Mahesh Narain Tandon

STUDENTS (*contd.*)

No.	Name	No.	Name
36929	Lajpat Rai Malik	36974	C. C. Thomas
36930	Bhagwan Raisinghani	36975	Arun Narahari Khardenavis
36931	Hari Prakash Misra	36976	Pandurang Udhao Purohit
36932	Tirath Kishore	36977	Deo Narayan Bhagat
36933	S. Kulathu Iyer	36978	Vibhakar Wamanrao Bhake
36934	Ramesh Dattatraya Joshi	36979	Mangla Prasad Srivastava
36935	Purshottam Lal David	36980	Umapati Mishra
36936	Suresh Raghunath Joshi	36981	Sanat Kumar Mitra
36937	Madhukar Ambadas Kurode	36982	Himmatrao Raghunathrao Parate
36938	P. Ramakrishna Iyer	36983	Aroon Keshaorao Muzumdar
36939	Vitthal Govind Kanade	36984	Kottum Veetil Madhavan Podhuval
36940	Sureshachandra Kashinath Bhatavdekar	36985	K. Thomas John
36941	Cpl. Ved Parkash Gaur	36986	M. Balakrishnan
36942	Indresh Kumar	36987	Daniel Samuel Arthur
36943	Ram Sarup Kaushal	36988	Munnu Ram
36944	Alimiya Kadar Parkar	36989	Suvendu Roy Chowdhury
36945	Kamanat Karathan Ravindran	36990	Sethuraman Balasubramanyam
36946	Punam Chand Bhawsar	36991	Narayanan Jayasandhan
36947	Nirmalendu Choudhury	36992	P. Geevarghese Koshy
36948	Ajit Singh Kalsy	36993	Deokishore Prasad Singh
36949	Bistesh Hanumantrao Sagar	36994	Tilak Raj Tuli
36950	M. Kesavan Vasavan	36995	Nimba Sadashiv Ahire
36951	Tarun Kumar Gupta	36996	Sat Dev
36952	Lakshmi Prasad Baruah	36997	Om Parkash
36953	Ram Chij Dubey	36998	Gowdara Basavarajappa
36954	Anthur Veetil Balakrishnan Nambiar	36999	Shive Kishan Vyas
36955	V. R. Hariharan Nair	37000	Pidakala Samson Prasanna Kumar
36956	Bhimrao Khushalrao Shirke	37001	P. Raman
36957	Mukund Gajanan Prabhu	37002	Madhusudan Natverlal Parikh
36958	Ishwarlal Tarachand Chhaproo	37003	Maya Ram
36959	Dara Bomanshaw Desai	37004	Mukund Purushottam Koranne
36960	Madhao Narayan Lote	37005	Kuldip Raj
36961	Guru Charan Singh Chhatwal	37006	Surendra Prasad Srivastava
36962	Sheo Prasad Gupta	37007	Abdur Raquib
36963	Gunvantrai Amratlal Parekh	37008	Ram Nath
36964	Tadinada Ramachandra Rao	37009	Jokhan Ram Vishwakarma
36965	Shrikrishna Vinayak Deshpande	37010	Pyarelal Sharma
36966	Ratnakar Vithalrao Mitkari	37011	Ramji Lal Sharma
36967	Thattankandy Choyi Chandrasekharan	37012	Kamlesh Kumar Goel
36968	Chonat Sreedharan Kutty	37013	Ram Murti Sood
36969	P. Mathai Zachariah	37014	Radhagobinda Mallik
36970	Shivgonda Anna Patil	37015	Kunwar Krishan
36971	Chandrakant Vithalrao Lahane	37016	Subir Kumar Basu
36972	I. Pathrose	37017	Padmakar Laxman Lange
36973	Sreenivasaiyer Venkataraman	37018	Amar Jit Singh

STUDENTS (*contd.*)

No.	Name
37019	Gour Gopal Brozobasi
37020	Ashok Kumar
37021	Surinder Mohan Khanna
37022	Ramanbhai Becharbhai Patel
37023	Nitaidas Ghosal
37024	Vimal Kumar Abrol
37025	Biswa Nath Mukhopadhyay
37026	Subhashchandra Bandyopadhyay
37027	Amarendra Nath Mitra
37028	Shanker Mohan Dey
37029	Subhasit Banerjee
37030	Arup Krishna Basu
37031	Abhik Kumar De
37032	Hans Lal Singh
37033	Krishna Damodar Kothari
37034	Sudhakar Shridhar Sarode
37035	Bhagwandas Tilokchand Manghani
37036	Divakar Sharma
37037	Thimmanoor Balur Ramachandran
37038	Manas Kanti Mitra
37039	Pranab Kumar Pal
37040	Subhas Chandra Das
37041	Sudhir Kumar Paul
37042	Sudhamoy Bandyopadhyaya
37043	Santosh Kumar Nag
37044	Subir Kumar Ghosh
37045	Hari Bijlani
37046	P. Vivekanandan Sathi
37047	Philip K. Joseph
37048	Rajinder Singh Chhabra
37049	S. Wafiullah
37050	Shyam Sunder Bansal
37051	Vijay Shanker Gaur
37052	Tapan Kumar Mitra
37053	Prakash Chandra Chatterjee
37054	Tanjore Ramanuja Krishnaswami
37055	Adengada Muddappa Poonacha
37056	Janak Narayan Misra
37057	Sita Ram
37058	Kamalesh Chandra Roy
37059	Dulal Chandra Samanta
37060	Sabyasachi Majumdar
37061	Dilip Kumar Mukhopadhyaya
37062	Hari Prasad Shrivastawa
37063	Dilip Kumar Chaklanobish
37064	Niharendu Dey
37065	Jayakumar Chunilal Doshi
37066	Abnash Chandra Kamra
37067	Samuel David
37068	Rudrakant Indrashanker Trivedi
37069	H. N. Subba Rao
37070	Om Parkash
37071	K. V. Jayaraju
37072	Puliyakot Mallinatha Menon
37073	Subramaniam Vishwanathan
37074	Prem Swarup Bhatnagar
37075	Ved Parkash Tyagi
37076	M. Viswanathan Karthikeyan
37077	C. Ramachandrasetty Satyanarayana Setty
37078	Sharaschandra Tuljaram Puranik
37079	Arunachala Balasubramaniam
37080	Rasiklal Sunderlal Jain
37081	Verander Kapoor
37082	Narendra Kumar Sharma
37083	Ajit Kumar Mukherjee
37084	Ajai Bahadur
37085	Gopal Mohan
37086	Gunvantrai Ranchhodji Desai
37087	Choorkunnu Ponnen Haridas
37088	Sundareshan
37089	Dilip Kumar Chatterjee
37090	Hebbatam Gururaja Rao
37091	Lakanagam Gururajachar Dwarakanath
37092	Mallanda Pemmaiah Devaiah
37093	Hanumanthrao Kashinathrao Walvekar
37094	Krishnasubramaniam Krishna Iyer
37095	Kotgal Shamasastry Channakeshava Murthy
37096	Chodappa Ramiah Nagaraj
37097	Suresh Vishrambhai Patel
37098	Anand Perkash
37099	S. Krishna Murthy
37100	G. Mallikarjunasastry Jagannath
37101	Manindra Mohan Kalraiya
37102	Dipak Mitra
37103	Santhana Gopala
37104	T. Bhagavathiappan
37105	Debi Prosad Kar
37106	Sadhu Singh
37107	Sheo Kumar Ram
37108	Trirumalachariar Booveraghavan

STUDENTS (*contd.*)

No.	Name
37109	Revanasiddhayya Gurulingayya Hiremath
37110	Prabhakar Prasad Singh
37111	Sanat Kumar Lahiri
37112	Surendra Kumar Singhal
37113	Rajaram Kisanrao Borekar
37114	Gopi Chand Wadhwa
37115	Triptydhan Banerjee
37116	Masaji Hariba Dange
37117	Raj Kumar Tripathi
37118	Mathuraimuthu Rajagopal
37119	Attiganal Venkatadasappa Krishnamurthy
37120	Tippasandra Ramachandraiya Gundappa
37121	Dhirajlal Popatlal Shah
37122	Bhagat Ram Goel
37123	Kalu Ram
37124	Suhas Kumar Chatterjee
37125	Manohar Lal Chadha
37126	Narendra Ji Ram Shrivastava
37127	Chhotelal Nanhelal Sahu
37128	Natabar Sahoo
37129	Vijay Ghatge
37130	Harbhajan Singh Kohli
37131	Bhaskar Vaman Patil
37132	Radha Binode Paul
37133	Gurmohan Singh
37134	Ramesh Chander Dhingra
37135	Juginder Singh Verma
37136	Ratish Chandra Sharma
37137	Pronabesh Kumar Goswami
37138	Bishnucharanarabinda Mohanty
37139	Madan Mohan Singh Deopa
37140	Vishvanath Bhadkamkar
37141	Shri Prakash Gupta
37142	Calamur Ananthanarayanan
37143	Hejmady Narayana Rao
37144	Pramod Balkrishna Jaywant
37145	Hanamant Vinayak Deshpande
37146	Syed Jarrar Husain Rizvi
37147	Silla Koteswar
37148	Jagdeesh Prasad Tripathi
37149	Daya Shanker Misra
37150	Purushottam Lal Agrawal
37151	Thomas Mathew
37152	Vasantarao Hanamantarao Dhamal
37153	Autar Krishen Khazanchi
37154	Vishnu Datt Sharma
37155	Mahesh Chandra Mital
37156	T. K. Siddaramaiah
37157	Madan Lal Gupta
37158	Taranikanti Venkata Rama Jagannadha Sarma
37159	Krishan Parshad Kalia
37160	Amarpal Singh
37161	Ashok Kumar Shukla
37162	Ishwari Prasad Sharma
37163	Manohar Vishram Alwe
37164	Jagjit Singh Bedi
37165	Prabhu Tatyaba Ghodke
37166	Gur Dial Datta
37167	Kanayo Topandas Jhurani
37168	Ajay Kumar Nandy
37169	Nanak Chand Haswani
37170	Inder Sen Dhawan
37171	Jitender Nath Kalia
37172	Mohinder Singh
37173	Arcot Panchaksharam Sivaraman
37174	Kalangimedu Srinivasan Ramanathan
37175	Vinod Krishna Ojha
37176	Samarendra Nath Chakraborty
37177	Jibeschandra Sur
37178	Cheruvillayil John Varghese
37179	Santosh Kumar
37180	Suresh Ramchandra Abhyankar
37181	Harish Chander Sharma
37182	Rabindra Nath Roy
37183	Ram Prasad Sharma
37184	Tulsi Dass Sadana
37185	Heera Lal Sharma
37186	Gajananrao Narayanrao Gokhale
37187	Ramesh Narayan Ghatge
37188	Shodavaram Prabhakara Rajan
37189	Mam Chand Jagdave Sharma
37190	Vishwa Nath
37191	Lakhmir Singh
37192	Prem Chandra Tayal
37193	Surinder Mohan Chadda
37194	Girish Kumar Namdeo
37195	Hara Ram Pal
37196	Narender Nath Sondhi
37197	Ram Kumar Sharma

STUDENTS (*contd.*)

No.	Name
37198	Sarat Chandra Patnaik
37199	Ram Kishan
37200	Yog Raj Kalra
37201	Ram Kishore
37202	Krishna Gopal Sharma
37203	Padam Parkash
37204	Krishan Murari Gupta
37205	Lakhanlal Gupta
37206	Pramoda Chandra Das
37207	Satyendra Swarup Bhatnagar
37208	Umesh Narayan Sinha
37209	Raj Kumar Duggal
37210	Ram Chand Kalra
37211	Kailash Chander Rampotra
37212	Teja Singh Gill
37213	Ravi Prakash Agrawal
37214	Dilip Kumar Sarkar
37215	Rameshwar Dass Gupta
37216	Saktipada Mukhopadhyay
37217	Kalyan Chatterjee
37218	Hirendranath Bishnu
37219	Krishna Chandra Sahoo
37220	Venkatachariyar Govindan
37221	Raj Behari Lal
37222	Surya Narayan Dash
37223	Ram Lal Gupta
37224	Gopal Krishan Bhalla
37225	Adwait Charan Mohanti
37226	Om Prakash Puri
37227	Prabhat Kumar Pande
37228	Prem Parkash Khanna
37229	Prem Sagar Gupta
37230	Ram Chander Bhatia
37231	Pingali Venkatramaiah
37232	Ranjeet Kumar Chatterjee
37233	Subal Basak
37234	Bhaskar Gajanan Shere
37235	Hari Krishna Mehta
37236	Kishan Singh
37237	Surjit Singh Gugneja
37238	Sajad Hader Qureshi
37239	Krishna Swarup
37240	Om Parkash Gupta
37241	Narinder Lal Bagga
37242	Ram Pravesh Singh
37243	Avinash Chandra Prabhakar
37244	Chhatu Ram
37245	Nagireddi Balaramaswamy
37246	Sodagar Mal
37247	Chandra Kant Verma
37248	Kali Das
37249	Kishori Lal
37250	Rajendra Kumar Sharma
37251	Ram Janam Sharma
37252	Roshan Lal Thapar
37253	Harbans Lal
37254	Balkrishnan Ranganathan
37255	Bishamber Lal
37256	Mahipal Singh Panwar
37257	Mohan Bhatia
37258	Shambhu Dayal
37259	Veerappa Sethappan
37260	Cpl. P. K. Rajendra Nambiar
37261	Mohindar Singh Grewal
37262	S. Govindarajan
37263	Krishan Kumar Gupta
37264	Periyalaplackal Ouseph Chacko
37265	Vayumattom Sebastian Mathew
37266	K. Ananthanarayanaiyer Venugopalan
37267	Kewal Krishan Kapoor
37268	Kishanlal Bani
37269	Jaleshwar Nath Sinha
37270	Devi Prasad Sahu
37271	Roberts Osbourne
37272	Om Prakash Gupta
37273	Shyamjee Upadhyay
37274	Mahendra Nanda
37275	Devaraj Nayak
37276	Prediman Krishen Kitchlu
37277	Krishna Pal Singh
37278	Avimanyu Patnaik
37279	Sharam Singh.
37280	Ashok Kumar Chib
37281	Mrinal Kanti Pal
37282	Jayanta Kumar Jena
37283	Krishan Chandar
37284	Chandra Bhooshan Chouhan
37285	Brij Mohan Garg
37286	Abhimanyu Singh
37287	Gutta Sreekrishna Rajendra Prasada Rao

STUDENTS (*contd.*)

No.	Name
37288	Gopal Ram Sahoo
27289	Haraprasad Bhattacharya
37290	Rishi Kant Srivastava
37291	Cherukuru Satyanarayanan
37292	Y. Jayatheerthachar Sethumadhava Char
37293	Krishan Kanaya Madan
37294	Hari Shanker Rastogi
37295	Lalu Thawani
37296	Somasundara
27297	Shyam Lal Gogia
27298	Nand Lal Chugh
27299	Modathi Karuvath Valsan
37300	Lokanath Mishra
37301	Binod Bihari Ghosh
37302	Makhan Lal Bhan
37303	Hari Krishan
37304	Gajadhar Prasad Sheobare
37305	Antonysamy Louis
37306	Babu Lal Singh
37307	Madan Mohan Makker
37308	Vishweshwarprasad Madhavlal Pandya
37309	Hriday Narain Ram
37310	Ishwar Chander Gupta
37311	Krishnamoorthy Kokkirala
37312	Shyam Sunder Gupta
37313	Revanna Someshekharappa
37314	P. K. Poulose
37315	Vijay Kumar Raina
37316	Madan Mohan
37317	Har Gobind
37318	Kasturi Lal Arora
37319	Venkataraman Balasubramaniyan
37320	Anirudha Patra
37321	Navrose Taimurusp Badhniwala
37322	Satish Chandra Singhal
37323	Bal Krishna Handa
37324	Mohammad Iqbal Ahmad
37325	Jaswant Singh Virk
37326	Kshiteshwar Pandey
37327	Ramprakash Shrivastava
37328	Chandrasekhara Durgaprasad
37329	Shiv Kumar Sharma
37330	Ranjan Nanikram Dadlani
37331	K. R. Adinarayana
37332	Manjit Singh
37333	Madan Mohan Kapoor
37334	Subhash Chandra Sinha
37335	Devendra Kumar Dani
37336	Hari Krishna Gupta
37337	G. Subba Ramiah
37338	C. Syed Abdul Jaleel
37339	Dattatraya Narayanrao Jakate
37340	Syed Mohammad Tarique
37341	Polepeddi Venkateswara Sharma
37342	Rajendra Singh
37343	Sailendra Nath Chakraverty
37344	Ram Prakash Upadhayay
37345	Mahendrawada Venkata Lakshmi Narasimham
37346	Charanjit Lal Garg
37347	Pramod Kumar
37348	Sadashiv Namdeo Inamdar
37349	N. Ponnambalam
37350	Nagendranath Mohanty
37351	Awadh Bihari Lal Shrivastava
37352	Mohan Keshav Kanade
37353	Suresh Raghunath Pingale
37354	Vinodchandra Ishwarbhai Patel
37355	Madhukar
37356	Brij Mohan Singhal
37357	M. N. Ramakrishnan
37358	Ravindra Narayan Bhatt
37359	Chandrashekhar Laxmikant Pande
37360	B. V. Panduranga Setty
37361	Atindraprasad Dasgupta
37362	Yashoda Nand Dubey
37363	Satish Chandra Sethi
37364	Ganpatlal Manilal Agarwal
37365	Nityaranjan Boyal
37366	P. Somasekharaiah
37367	Bipinchandra Chimanlal Modi
37368	Vempati Satya Suryanarayana
37369	Chuni Lal Dhar
37370	K. R. Pattabhiraman
37371	Narasinha Mahapatra
37372	Lal Chand Nagrath
37373	P. Somasundaran
37374	Sita Ram Pandey
37375	Sultan Singh
37376	Hari Narain Lal

STUDENTS (*contd.*)

No.	Name	No.	Name
37377	Harish Chandra Taneja	37422	Manilal Ishwardas Patel
37378	Madhab Bandyopadhyay	37423	Darshan Kumar
37379	Daya Krishan Ghaiye	37424	Deepesh Yashwant Kane
37380	Keri Vittal	37425	Rajeshwar Dayal Seth
37381	Hans Raj Banga	37426	Satwinder Balwant Singh Bedi
37382	Sanwalia Prasad	37427	Hafizur Rahman
37383	Vasant Gangadhar Chaudhary	37428	Mahadeo Prasad Gupta
37384	Diwakar Laxmanrao Wadagbalkar	37429	Manas Kumar Nag
37385	Dinesh Prasad	37430	Bishamber Dayal Sharma
37386	Shyam Nandan Lall	37431	Ramanbhai Narsinhbhai Rathod
37387	Pritpal Singh	37432	Amiya Kumar Bhattacharya
37388	Man Mohan Rai Gujral	37433	Tapendra Nath Paul
37389	Ramanpillai Janardanan Nair	37434	Dowlagar Rajalingeshwar Rao
37390	Mihir Ranjan Sarker	37435	Charan Singh
37391	Ponnuswami Naidu Avudaiappan	37436	Penmetsa Seetharamaraju
37392	D. Dowlath Rao	37437	Musipatla Prabhaker
37393	Gauri Shanker Gupta	37438	Manohar Lal Jain
37394	Solomon Daniel Dharmaraj Gunasekar	37439	Vadakancherry Viswanath Parameswaran
37395	Pongiagounder Muthuswamy	37440	Ajay Kumar Ghosh
37396	Raghavan Gireesa Babu	37441	Salil Kumar Ghosh
37397	N. S. Balakrishnan	37442	Bimal Chandra Kundu
37398	Mohinder Kumar Bhatla	37443	Harish Bawa
37399	Narayanannayar Karunakaran Nayar	37444	Shyamal Kumar Ganguli
37400	Ramesh Chandra Joshi	37445	Sanat Kumar Dhol
37401	S. Narasimha Rao	37446	Anil Kumar Banerjee
37402	Srihari Narayana Katneni	37447	Shashanka Mukherjee
37403	Mulk Raj Bedi	37448	Tarak Nath Dey
37404	Basant Rai Prabhakar	37449	Mantripragada Sambasiva Rao
37405	Raghu Kul Khulban Sawhney	37450	Suhas Wamanrao Kulkarni
37406	Swaran Singh Bhatia	37451	Harbans Singh Saroya
37407	Bikramajit Singh Randhawa	37452	Ramapati Ghoshal
37408	Dalip Singh Thind	37453	Bhajan Das Sapra
37409	Chandrashekhar Gundappa Amble	37454	Ved Parkash Saini
37410	Vojjala Laxmirajam	37455	Kolluru Ramarao
37411	Raghu Raj Singh	37456	Vishnu Prakash Agarwal
37412	Shyam Sundar Lal	37457	Ram Kishan Gaur
37413	Vasudeo Hanmant Kulkarni	37458	Dilip Kumar Mitra
37414	Rajaram Sadashiv Ranade	37459	Harilal Sugumal Chablani
37415	Harish Chandra Sharma	37460	Jitendra Singh
37416	Aravind Bhaskar Tipnis	37461	Kunnathur Subramania Rajamani
37417	Surendra Sadashiv Sarode	37462	Kisan Laxmanrao Lad
37418	Madan Lal Garg	37463	Prem Sagar Nagia
37419	Nandikattu Venkateswarlu	37464	Ghanshyam Ambalal Bhatt
37420	Mohinder Kumar Gupta	37465	Gurudas Bhattacharya
37421	Rajendra Singh	37466	C. A. Jagannatha Rao

STUDENTS (*contd.*)

No.	Name
37467	Govind Parshuram Dixit
37468	Athuri Radha Krishna Rao
37469	Yashwantray Narmadashankar Yajnik
37470	Sardool Singh
37471	Vijay Shanker Bhargava
37472	Dharam Chand Virdi
37473	Sanagavarapu Venkata Ratnam
37474	Narendra Krishna Nag
37475	Nunna Narayana Rao
37476	Pankaj Ambalal Nanavaty
37477	Ajit Kumar Sircar
37478	Surendra Kumar Khanna
37479	Biresh Chandra Sarkar
37480	Bimal Kanti Ray
37481	Guru Pada Bhar
37482	Prem Singh Bawa
37483	Dipendra Nath Biswas
37484	Ranjit Kumar Paul
37485	Ranchhodbhai Ambalal Patel
37486	Ramgopal Dhar
37487	Madan Gopal Mittal
37488	Sital Parkash Jain
37489	Taraprasanna Bhandari
37490	Shrikant B. Bhansali
37491	Bharat Chandra Trivedi
37492	P. B. S. Govindarajan
37493	Bishnu Sadhan Koley
37494	Joy Prokash Majumder
37495	Swapan Kumar Basu
37496	Benu Lal Bhattacharjee
37497	Dipak Ghoshal
37498	Nripendra Chandra Das
37499	Hardial Singh
37500	Narinder Nath Chandha
37501	Tapan Kumar Mitra
37502	Ajoy Kumar Guha
37503	Prem Ratan Ladha
37504	Amal Prasad Ghosh
37505	Rudra Narain Anand
37506	K. R. Venkitachalapathy
37507	Sujit Krishna Paul
37508	Jugal Krishna Paul
37509	Kashmir Mallik
37510	Pushkar Nath Vatal
37511	Shri Ram Soni
37512	Inder Mohan Khanna
37513	Bhajan Lal
37514	Vallabh Swaroop Maheshwari
37515	Ramakrishna Vinayak Patwardhan
37516	Mallam Prabhakara Reddy
37517	Madan Lal Singal
37518	Goura Chandra Mahapatra
37519	T. N. Bhatnagar
37520	Prem Prakash Mehra
37521	Saraswati Prasad
37522	Bhanwar Lal Mundra
37523	Andoji Madhava Rao
37524	Rabindra Nath Ray
37525	Wing Chong Tham
37526	Arun Kumar Bhattacharyya
37527	Sailendra Kumar Ghosh
37528	Sourendra Nath Roy
37529	Satish Chandra Debnath
37530	Vishwamitra Mital
37531	Chittaranjan Bhattacharya
37532	Som Deo Yadav
37533	Suresh Kumar Gupta
37534	Krishna Mohan Misra
37535	Mahendra Pal Singh
37536	Pandal Pratap Lingam
37537	Yudhisthir Sharma
37538	Kashmiri Lal Bhanot
37539	Tara Chand
37540	Sukumar Dey
37541	Bhaskar Chandra Maji
37542	Sri Kishen Dhar
37543	Hazari Lal Jangid
37544	Abburi Balakrishna Rao
37545	Bimalendu Sahu
37546	Rupo Balani
37547	Om Prakash Verma
37548	Debabrata Banerjee
37549	Devdas Keshavdas Narsian
37550	Divakar Prakash Verma
37551	Vallabh Bhai Purohit
37552	Shyam Sunder Shukla
37553	Vijai Prakash Srivastava
37554	Om Parkash Jally
37555	Subhash Chandra Khan
37556	Prem Nath Handa

STUDENTS (*contd.*)

No.	Name
37557	Narasimhan Balagandar
37558	Mohanlal Thakurdas Vazirani
37559	Debabrata Basu
37560	Jayanta Kumar Das
37561	Dilip Kumar Samanta
37562	Rabidas Basu
37563	Saripalle Narayana Rao
37564	Ravindra Nath Handa
37565	Jeth Raj Purohit
37566	Vijay Kumar
37567	Dayal Tarachand Bhojwani
37568	Arjan Chabaldas
37569	Ramesh Kumar Bhambhani
37570	Galibbe Veeranna
37571	Nitya Kumar Sarkar
37572	Uma Shanker Sahai
37573	Sugata Mukherjee
37574	Ranabesh Datta
37575	Asim Kumar Mandal
37576	Ashis Ranjan Bal
37577	K. Chura Singh
37578	Pankaj Kumar Mitra
37579	Chitta Ranjan Chanda
37580	Rajendra Nath Burma
37581	Cheetayil Elayanairu-Veetil Narayanan Nair
37582	Narendra Singh Rathor
37583	Poolla Ananta Venkata Rama Krishna Murthi
37584	Subramaniaiyer Ramanathan
37585	Luckyreddy Indraseena Reddy
37586	Vasant Ramachandra Potdukhe
37587	Gonda Ramachandra Murty
37588	Punyamurtula Venkataramana
37589	Amalendu Paul
37590	Gulab Chand Vijay
37591	Swapan Kumar Choudhury
37592	Jagadis Chandra Pal
37593	Melkiade Patrao
37594	Tarunchandra Devshanker Purohit
37595	Polagani Vara Pralada Rao
37596	Rallabandi Radhakrishna Moorthy
37597	Ambujaksha Banerjee
37598	B. P. Prabhakaran
37599	Kamaruddin Gafoor Shaikh
37600	Ramendra Nath Satpathy
37601	Biswanath De
37602	Amarnath Roy
37603	Ajoy Mookherjee
37604	Dulal Kumar Ghosh
37605	Biswarup Mitra
37606	Joginder Singh Lobana
37607	Nirmal Singh Gosal
37608	Shivagauda Babugauda Patil
37609	Ram Kumar Agarwal
37610	Kuppili Hara Prasada Rao
37611	Uddaraju Krishnam Raju
37612	John David Selvaraj
37613	Peruri Satyanarayana
37614	Jyoti Prosad Burman
37615	Sewa Singh
37616	Satyawant Lal Sehgal
37617	Ramakant Gajananrao Kaore
37618	Chalissery Joseph Cherian
37619	Govindram P. Gurbaxani
37620	Rupchand Banerjee
37621	Thongaly Manavendra Rai Varma
37622	Nirmal Kumar Das
37623	Surendra Singh Sirohi
37624	Ramalinga Reddy
37625	Asit Kumar Das
37626	V. K. Ummer
37627	K. P. Joseph
37628	Moni Eappen
37629	K. V. Asokan
37630	K. Narayanan Kunji
37631	Punnoli Irippattil Balagopalan
37632	Padmanabhan Bhasai
37633	E. Balan
37634	V. E. Vamanan Namboodiri
37635	Pandurang Bhairnath Kangralkar
37636	Vijay Wasudeorao Bino
37637	Om Prakash Rawal
37638	Dulal Krishna Sen
37639	Rithi Sathya Gururajachar
37640	Korrapaty Sriramurty
37641	Raj Krishan Bhandari
37642	Suresh Pandurang Nirokhekar
37643	Rao Venkata Krishnarao
37644	Pralhad Baburao Ashtekar
37645	Sistla Sivaprasad

STUDENTS (*contd.*)

No.	Name	No.	Name
37646	Susanta Kumar Kundu	37691	Nimai Chandra Das
37647	Donti Ratnam Gupta	37692	Racherla Raghava Rao
37648	Munagavalasa Krishna Rao	37693	Sunilendu Ray
37649	Nirmal Chandra Chatterjee	37694	Nandakumar Shivram Kolekr
37650	Debananda Prasad Mitra	37695	Chander Mohan Dhawan
37651	Susanta Kumar Das	37696	Bikram Kishore Bhowmick
37652	Kedareswar Bandyopadhyay	37697	Subhash Chandra Basu
37653	Tushar Kanti Ghosal	37698	Shiva Kumar Tiwari
37654	Krishna Gopal Dhar Chaudhuri	37699	Balwant Ganpatrao Dandekar
37655	Prafulla Kumar Kar	37700	Arjun Singh Parmar
37656	Ganga Ratan Damani	37701	Amitava Banerjee
37657	Shyamal Kumar Chattopadhyay	37702	Panikkaveetil Balachandra Menon
37658	Athmanatha Venkata Raman	37703	Bhaskar Devidas Shimpi
37659	Ananda Gopal Goswami	37704	Ghuriki Parthasarathy
37660	K. Madhavan Pillai	37705	M. Sreenivasarao Panduranga
37661	K. P. Padmanabhan Nair	37706	Munegowda Nanjundappa
37662	Nalavenkatagari Muralikrishna	37707	Akkasale Narasimhamurthy
37663	Ramakrishna Narayan Upadya	37708	Sitaram Kedia
37664	Mohammed Yousufuddin Ahmed	37709	Vailepilly Raman Thilakan
37665	Santanu Biswas	37710	K. Ganapathy Sri Raman
37666	Raghu Nath Padhi	37711	Vikramsing Mondhusing Girase
37667	Bhalchandra Vishnoo Agashe	37712	Pijoosh Kanti Dey
37668	Tadepalli Suryanarayana Murty	37713	Teerath Pal Singh
37669	Gullapalli Venkata Subrahmanyam	37714	Suraj Prakash Girottee
37670	Conjeevaram Parasuram Sreenivasan	37715	Indrapal Nathurao Chaukeey
37671	Maharaj Singh Verma	37716	Prithipaul Singh
37672	Anil Baran Nandi	37717	Chimanbhai Bhagwanjibhai Patel
37673	Basitullah Khan	37718	Hari Prakash Goel
37674	Meduri Naga Vithal Vallabheswara Rao	37719	Rajendra Kumar Jain
37675	Sidadaragallu Lakshmi Narayana Rao	37720	Jaswantlal Motiram Modi
37676	Sham Sunder Arora	37721	Hardev Singh
37677	Inder Ramchand Chawla	37722	Gajanan Dattatraya Deshpande
37678	Prabhu Nath Singh	37723	Priyanath Nanda
37679	Suresh Vasudeo Dixit	37724	Ram Kishan Saini
37680	Matsyendra Balkrishna Trivedi	37725	Mahesh Chandra Paliwal
37681	Arup Roy	37726	Satwant Singh Bawa
37682	Mamraj Baldas Udasi	37727	Amarjit Singh Cheema
37683	Raghuvansh Narain Mathur	37728	Bal Kishan Verma
37684	Satish Chandra	37729	Joseph Anjilvelil George
37685	Sham Dass Mehta	37730	Raj Kumar Sharma
37686	Raghunath Laxmanrao Mirajkar	37731	Kallakuri Janakiram
37687	Prabhakar Haribhau Dalvi	37732	E. T. Achuthan Nambiar
37688	Bhag Singh Sobi	37733	A. R. Govinda Rao
37689	Gyan Chandra Jain	37734	C. H. Hanumappa
37690	Ram Sewak Chaturvedi	37735	Doraiswamyiyengar Keshavan

STUDENTS (*contd.*)

No.	Name
37736	Surjanarayana Rao Viswanath
37737	Madathilkovilakath Ramavarma Raja
37738	Bijoy Krishna Bera
37739	G. K. Gopal
37740	Gurudatha Prabhu
37741	Bangalore Aswathanarayana Rao Narayana Swamy
37742	H. R. Shantaveeriah
37743	Bal Mukund
37744	Krishan Kumar Malhotra
37745	Harikant Kirpashanker Trivedi
37746	Dattatraya Ramchandra Kulkarni
37747	Bhupendra Shantilal Vora
37748	Surinder Singh
37749	Gajanan Kashinath Deuskar
37750	Pushap Raj Chabra
37751	Ramrao Balwantrao Ghonge
37752	Krishna Lal Punjabi
37753	Satyavart Arya
37754	Sureshchandra V. Gupte
37755	Rabinarayan Mohanty
37756	Nrusinha Charan Khuntia
37757	Prithi Chand Nag
37758	Balkrishna Ramchandra Bongale
37759	Mastan Singh Grewal
37760	Prithvi Raj Pathak
37761	Lakshman Dass Kathuria
37762	Narendrakumar Kantilal Pandya
37763	Surinder Kumar Mahendru
37764	Prabhat Kumar Rawat
37765	Vasantkumar Somalal Trivedi
37766	Angad Lal Srivastava
37767	Pishori Lal Passi
37768	Somasundaram Natarajan
37769	Ulhas Shridhar Magikar
37770	Om Parkash Kochar
37771	Bhalachandra Vishwanath Sinnarkar
37772	Dharmadhar Arya
37773	Ganga Prasad Vidyarthi
37774	Om Parkash Kapoor
37775	Ubhayakar Ramachandra Shankarnarayana Rao
37776	Rudramani Pradhan
37777	Yog Raj Kohli
37778	Rajaram Mangesh Sinay Kantak
37779	Narayan Ramu Choudhari
37780	H. Subramhanyaiah Suranarayana
37781	Gopal Krishan Chawla
37782	Ranjit Lal
37783	Vidya Rattan Beri
37784	Ramesh Kumar Wadhawan
37785	Jaswant Singh
37786	M. Padmanabhan Pillai
37787	Jagdish Sahai Saxena
37788	Ganapati Vishwanathrao Datey
37789	Avinash Bhaskar Ranade
37790	Sharashchandra N. Thattee
37791	Ashwani Kumar Arora
37792	P. Premachandran
37793	Ramchandra Chidambar Yardi
37794	Madhukar Daji Lad
37795	Arun Kumar Patra
37796	Jagdishchandra Ishverlal Shah
37797	K. Seshan Arunachalam
37798	Swadesh Babu
37799	Panchaksharayya Virupakshyya Hiremath
37800	Kollipara Raghava Rao
37801	Puthanmadham Krishnaiyer Venkatakrisharam
37802	Koppisotti Valy
37803	Tushar Kanti Mishra
37804	Vankayala Gopala Krishna Rao
37805	Mahadeb Kumar Sarkar
37806	Navinchandra Mathuradas Lad
37807	Krishnaswamy Krishnamurthy
37808	Jag Mohanlal Mathur
37809	Chand Prakash Katyal
37810	Laxman Gajanan Shaligram
37811	Om Parkash
37812	Kannakram Rangnath Pillay
37813	Omkar Nath
37814	Dattatraya Narayan Kulkarni
37815	Nemlal Deviram Gawali
37816	Resham Singh Gulahti
37817	D. Krishna Moorthy
37818	Chander Parkash Gandhi
37819	Awtar Singh
37820	Partap Singh Dhupar
37821	Vazhappilly Kunjuvareed Kuriakose
37822	Harbans Lal Jaggi

STUDENTS (*contd.*)

No.	Name
37823	Dashrath Prasad Gupta
37824	Malur Sreenivasaiyengar Sampath
37825	Avtar Singh
37826	Shyam Sunder Patel
37827	Doddallapur Karigiri Subbanna Char
37828	Rumi Keki Mulla
37829	Ashok Ramdas Kelkar
37830	Rakesh dua
37831	Bhim Sen Khurana
37832	Palapati Narasimha Reddy
37833	Inder Sen
37834	Satish Kumar Pruthi
37835	Sharad Chandra Taore
37836	K. K. Abdul Rahiman
37837	Sudhakar Bhaskar Bibwe
37838	Limaji Narsai Patil
37839	Harinder Pal Puri
37840	Nirmal Kumar Nihalani
37841	Abdeali Taiyebali Haji
37842	Shishir Kumar Mukerji
37843	Khanabhai Kacharabhai Parmar
37844	Prahlad Singh
37845	Kewal Krishan Bajaj
37846	Raj Kumar Welacha
37847	Balkrishan Gorelal Chouksey
37848	Pratipal Singh Panesar
37849	Vitthalbhai Bhikhabhai Patel
37850	Pran Shanker Danayak
37851	Indir Assanand Gursahani
37852	Kishorchandra Dayaljibhai Desai
37853	Syed Alamdar Husain Rizvi
37854	Vishwambhar Dayal Badaya
37855	Satishchandra Mugatlal Dalal
37856	Balai Chand Mitra
37857	Maheshchandra Anopchand Gandhi
37858	Balkrishna Vishnu Joshi
37859	Dilip Kumar Roy
37860	Dilip Damodar Saraf
37861	Raj Sarup Sethi
37862	Inder Jit Budhiraja
37863	Shashikant Gopal Wadalkar
37864	Ananda Rarayana Pai
37865	V. K. Ravindran
37866	Hemant Narayanrao Jakate
37867	Makhan Singh Gothre
37868	Ramesh Chand Bansal
37869	Pandit Dhanaji Chaudhari
37870	Haribhai Laxmidas Prajapati
37871	Keshava Ram
37872	Mahabir Prasad Mittal
37873	Batubhai Ambelal Desai
37874	Atulkumar K. Doctor
37875	K. S. Ramaswamy
37876	Mugur Krishnamurthy Narahari
37877	A. N. Poosalingam
37878	Chandrashekariah Gautham Kumar
37879	Ripudaman Singh Bhatia
37880	V. Srinivas
37881	Channabasappa Rudramuni
37882	Narayanrao Mohan Rao
37883	Chakravarthy Krishnaiyengar
37884	Kodihalli Ramaswamaiah Jayarama
37885	Yeshawant Pundalik Thakare
37886	Chandrasekariah Srikantiah Ragha Vendra
37887	Kedla Shankar Rao
37888	Kuldip Singh
37889	Jawaharlal Damumal Katri
37890	Subbarao Vittal Rao
37891	Bangalore Rangaswamy Nagaprasanna
37892	Meneth K. Abdulla Kunhi
37893	Vittapu Prabhakar
37894	M. Keshava Prabhu
37895	Narayan Namdeorao Khadse
37896	Bhikabhai Somabhai Tandel
37897	Shreeram Shankar Amrite
37898	Adrian Dominic Mark Anthony Daniel
37899	Koodikavu Kizhakku Madham Krishnamoorthy
37900	Manjaya Gangaya Shetty
37901	Bhagavanji Narandas Attara
37902	Shivananda Ramchandra Shetti
37903	Stephen Marian Pereira
37904	Vishnu Datt Dhyani
37905	Sivaramakrishnan Parameshwaran
37906	Harjas Menghraj Ahuja
37907	Prirbhu Chellaram Soni
37908	Sadashiv Madhusudhan Palkar
37909	Gobindram Wadhwani Pahlaj
37910	Monoranjan Bhadra
37911	Kailash Chand

STUDENTS (*contd.*)

No.	Name	No.	Name
37912	Santokh Singh Gill	37957	Parathanam Joseph Joseph
37913	Gobind Ram	37958	K. Gopalakrishnan
37914	Rattan Lal Chablani	37959	Kochappanchettiar Rajaveerappan
37915	Raghbir Chand Dheer	37960	Mandakolathur Subramanian Viswanathan
37916	Nippani Krishnamurthy	37961	Ebenezer Smith
37917	Ram Sarup Bhatia	37962	A. Harish Menon
37918	Prakash Chander	37963	Koodathinalil Chacko Geevarughese
37919	Triloki Nath Bhatnagar	37964	M. T. Thomas
37920	Satya Pal Khurana	37965	Natarajan Sundaram
37921	Sham Singh Blah	37966	Perumal Govindaswamy
37922	Gurnam Singh Mehta	37967	Mahalinga Yeshwant Rao
37923	Jaldhari Singh Kushwah	37968	Bavikati Gangaiah
37924	Piare Lal Handa	37969	Krishnan Ashoke Kumar
37925	Budhi Prakash Bansal	37970	Venugopalaiyer Ramadorai
37926	N. R. Syamanarayanan	37971	Rangachari Narayanan
37927	Adusumelli Satyendra Prasad	37972	Madanamurthi Chandramohan
37928	Erukulapaty Venkateswarlu	37973	Padi Chandrasekara Sukumar
37929	Rajkumar Singh Bhandari	37974	Srinivasan Santhanam
37930	Kottaru Siddheswara Dikshitulu	37975	Dandu Satyanarayana Raju
37931	Murlidhar Balwantrao Joshi	37976	P. V. Bhaskara Satya Dhana Pathi
37932	Kolli Seeta Ramaiah	37977	Krishnaraju Subba Raju
37933	Cherukupalli Harinath	37978	T. K. Raman
37934	Indrajit Singh	37979	Pinnu Venkata Krishnamurthy
37935	Raj Pal Kakkar	37980	Venkataramaiyer Sundararaman
37936	Vinaya Shanker Shukla	37981	Krishnamurthy Nara Simha
37937	Swami Dayal Tewari	37982	Venkatraman Raghavan
37938	Ram Narain Sharma	37983	Chavvakula Balarama Krishna Murthy
37939	Kalamad Chacko John	37984	Harjit Singh
37940	Bala Surya Prakasa Rao	37985	Jagannath Thakur Gopal
37941	William Joseph	37986	Kunnuthur Parinjaregath Cheria Sankaran
37942	Palchani Venugopala Reddy	37987	M. A. Anthony
37943	Gurjit Singh Aulakh	37988	Gopal Mahadeo Pandit
37944	Palaveri Srinivasachari Rangachar	37989	Panthangal Narayanan Kutty
37945	G. N. Jyoti Shankar	37990	Y. V. Narasimha Kameswara Rao
37946	S. Sam Joseph	37991	Gopal Singh Sarine
37947	Thandalam Ganesamudliar Nithyanandam	37992	K. P. Mohendranath Menon
37948	P. Nancharaiah	37993	Chandir C. Dudia
37949	Narayanaswamiyer Sambasivam	37994	Padmanabhapillai Ramachandran
37950	Balaji Rao Ghodke	37995	Kuldip Chander
37951	Bomma Subbarami Reddy	37996	Ram Newaj
37952	Yalamati Subba Rao	37997	Satya Deo Pandey
37953	Venkatramana Subramanya Bhat	37998	Ramesh Chandra Arora
37954	Rupanagunta Radha Krishna	37999	B. Ramaswamy Iyengar
37955	Vuchintalabrahmam	38000	Kanayo Raisinghani
37956	Mukuteswara Gopalakrishnan	38001	Raj Narain Tripathi

STUDENTS (*contd.*)

No.	Name
38002	Kunjachan Chirayil -
38003	Bhagawatiprasad Nathalal Pandya
38004	Ishwar Das Menghani
38005	Govind Ram Premi
38006	Bansi Lal Jain
38007	Surendra Singh Gahlot
38008	Khem Chand Jain
38009	P. S. Santhanam
38010	Dev Raj
38011	R. Ramachandra Naidu
38012	V. Ramadass
38013	B. R. Rajaram
38014	K. C. Kathirvelu
38015	Srinivasaraghavan Narasimhan
38016	Muthusamy Sundarajan
38017	Angarai Vembaiyer Ramamurthy
38018	Nataraja Vadivelu
38019	Swaminathan Gowri Sankaran
38020	K. Sivaprasad
38021	N. Seshadri Srinivasan
38022	Raghavan Sriraman
38023	J. Sankaran
38024	Krishnaswamy Subramaniam
38025	Narayanaswamy Sankaravijayan
38026	Venkataraman Ganesan
38027	Kalidindi Venkata Narayana Raju
38028	Ramaswamy Vedanayagam
38029	Naganatha Ramamoorthy
38030	K. Ramanathan
38031	Krishnan Ananthakrishnan
38032	Chandrasekharapuram Subramaniam Mahadevan
38033	N. Krishna Ayyar
38034	Krishnasabapathy Shanmugasundaram
38035	M. C. Jacob
38036	Alampallam Narayanan Sangameswara
38037	Rangasami Seshachalam
38038	Sanjeevi Rangiah Lakshimipathy
38039	Venkataramanan Sundarajan
38040	Srinivasan Seshadri
38041	Muniswamy Seeralan
38042	Tennalur Nagarajan Sathyamurthy
38043	C. Suryanarayana Natarajan
38044	Rama Nand Verma
38045	Kuchibhatla Yagnanarayana
38046	Ganapathi Subramania Mahalingam
38047	Krishan Parkash
38048	V. B. Subramanian
38049	M. Jayabalchandran
38050	Kedar Nath Gupta
38051	Ebrahimpillai Abdul Karim
38052	Alwaruchetty Venkata Subrahmanyam
38053	John Thomas
38054	Om Prakash Garg
38055	Prit Pal Singh
38056	Satish Chandra Agarwala
38057	Pronob Kumar Ghosh
38058	S. Natarajan
38059	Charan Pramod
38060	Virendra Kumar Arya
38061	Natesaiyer Ramaswami
38062	Alfred Francis Rajan
38063	Surendra Kumar Oberoi
38064	H. James Franklin
38065	Vaitheeswara Venkataramani
38066	Surendra Kumar Kulshrestha
38067	Keshav Dev Agrawal
38068	Satya Prakash Agarwal
38069	Vrendra Singh Agrawal
38070	Chandrika Singh
38071	Kushal Pal Singh
38072	Mohan Prasad Srivastava
38073	Krishna Kumar Shukla
38074	Loyanapalli Sree Ramulu
38075	Yovannadar Christian
38076	Perunthalaitudi Subramonia Swaminathan
38077	Serkulathu Vanchinathan Balasubramanian
38078	Dilip Kumar Chowdhury
38079	Rangaswamy Varadarajan
38080	M. V. Sadanandam
38081	Natesan Balasubramanian
38082	L. A. Lourduswamy
38083	Krishnamurthisastry Ramanathan
38084	Arjun Kumar
38085	N. S. Dakshinamurthy
38086	Avinash Swaroop Mathur
38087	Vinod Narain
38088	Yogendra Nath Sinha
38089	Venkataswamy Sriramulu
38090	Gur Prasad

STUDENTS (*contd.*)

No.	Name
38091	Kailash Bhushan Singh
38092	Indu Prakash Sharma
38093	Shikher Chandra Jain
38094	Satish Kumar Khurana
38095	Virendra Kumar
38096	Ashok Kumar Saxena
38097	S. Nandakumara Acharya
38098	Sawalinjoo
38099	Ramesh Chandra Kaushik
38100	Krishan Chand Gajwani
38101	Syed Husain
38102	Onkara Tirumalarao
38103	Bansri Lal
38104	Murari Roy Chowdhury
38105	Rajendra Swarup
38106	Satish Chandra
38107	Padmanabhan Ramani
38108	Rajagounder Rajappan
38109	Jitendra Singh Dutta
38110	Gulab Rai
38111	Bhaskar Narayan Nikam
38112	C. Mahalingam
38113	Nagaraja Ramachandran
38114	Narayanajosier Yegnaraman
38115	Mosur Subramaniam Padmanabhan
38116	Pennathur Seetharama Sundaresan
38117	C. R. Baskaran
38118	Narayan Ramakrishnan
38119	Renganathan Narayanan
38120	Aradhyula Venkateswarlu
38121	A. Samuel D. Money
38122	Rajan K. Joseph
38123	Candiyur Raghavachari Gopalarathnam
38124	Malempati Satyanarayana
38125	Pitchalinganadar Sankaranarayanan
38126	Mohammad Aquil Siddiqui
38127	Shiva Kumar Tiwari
38128	Karnam Thyagarajan
38129	Dharanikota Anjaneyulu
38130	A. J. Balasubramanian
38131	Kalapatapu Surya Vasudeva Sarma
38132	Rajamiyer Devarajan
38133	Honnahalli Venkataramana Rangarajan
38134	Mudigonda Chandra Sekhar
38135	N. Gnanasigamani
38136	Venkatasubba Narayanan
38137	P. Rupert Samuel Raj
38138	Ramakrishnan Vaithinathan
38139	Vaidyanathaswamy Rangarajan
38140	Kolluri Chandra Seekhara Rao
38141	Srinivasan Aravamudhan
38142	Bandar Subramaniam
38143	Matammudra Venkataramaiah Ramachandran
38144	Mahadeva Gopalakrishnan
38145	Ramaswamy Vijayarangam
38146	K. Govinda Rao
38147	Velamoor Krishnaswamy Vasudevan
38148	T. Panchapakesan Venkataraman
38149	Valappil Sreedharamenon Chandran
38150	K. Ganapathy Ramasamy
38151	R. Sankaranarayanan Rajagopalan
38152	R. Balasundaram
38153	Ram Karan Singh Chauhan
38154	Paramaguru Ganesan
38155	N. S. Unnikrishnan
38156	T. Ganesan
38157	Krishnaswamy Seshu
38158	Muthusamyraja Dharmalingam
38159	Arjun Lal Srivastava
38160	Chinniah Mayandy
38161	Jagadeesa Pattabiraman
38162	Syed Abdul Hadi
36163	V. Sankaranarayanan
38164	Venkatarama Kalyanaraman
38165	Niranjan Singh Rajput
38166	Vijay Kumar
38167	P. Oomen Eapen
38168	Chintamani Jagannath
38169	Alexander Kurien
38170	Mathur Pattabil Prabhakaran
38171	Mahalingam Srinivasan
38172	Rajagopalathiraj Venkatesalu
38173	Srinivasaiyengar Rengarajan
38174	Chockalingam Manickavelu
38175	Talpur Purushothaman
38176	Muthuswamier Sethuraman
38177	Thirukkarugavur Ramachandra Subramanian
38178	C. P. Parthasarathi Krishnaswami

STUDENTS (contd.)

No.	Name
38179	R. Krishnamoorthy
38180	S. Thiagarajan
38181	Dharni Dhar Tripathi
38182	Halasyanathan Venkatasubramanian
38183	G. Mathew
38184	Bhupathiraju Ramakrishna Raju
38185	Natesan Subramanian
38186	Batula Mutyala Rao
38187	Ismail Abdul Khyum
38188	Akkur Venkatesan Thirumalai
38189	D. Gaji Pathi
38190	S. Sriraghavan
38191	Chockalingam Loganathan
38192	Aluri Nageswara Sastry
38193	T. S. Soundara Rajan
38194	G. Sundararaj
38195	Subramaniam Mahalingam
38196	Srinivasan Veeraraghavan
38197	Bhimakunta Ramesh Rao
38198	Krishnaswamy Chandrasekaran
38199	B. Jayarama Rao
38200	M. Devoodu Mahadevan
38201	C. N. Divakaran
38202	Venkataraman Subramanian
38203	Periasami Naryanasami
38204	Krishnaswami Rajmani
38205	Varadarajan Selvarajan
38206	Vargis Varki
38207	Ramanathan Thiagarajan
38208	Iqbal Ahmed
38209	K. Neethiraj
38210	T. Periasamy
38211	Dakshinamurthy Swaminathan
38212	Asanar Rowther Abdul Kader
38213	Vedachalam Annadurai
38214	C. S. Rangadorai
38215	Kunjupillai Sahadevan
38216	T. Varadachariar Narayanan
38217	A. Rabindranathan Nayar
38218	M. Chidambaranathan
38219	Venkatarama Sundararaman
38220	Krishna Nagarajan
38221	Shamsuddin Gulamrasul Sayed
38222	Ramaswami Arumuga Gnaniar
38223	Chhaganlal Bhanjibhai Dasini
38224	K. P. Subramanian
38225	Mohammad Voli
38226	Duraisamy Rengarajan
38227	M. Lingaswamy
38228	Dhamal Narasimachari Vijayaraghavan
38229	Chimmakonda Sarangapani Chandramorrty
38230	Alfred Pinheiro
38231	Padhuvail Mathew Alexander
38232	Arokiaswmy Peter
38233	Vaidyanathan Sivaraman
38234	Sarangapani Venugopal
38235	Thirumagudy Sambasiva Radhakrishnan
38236	Narasamalpuram Sankaran Neelakantan
38237	T. A. Sankaranarayanan
38238	Abraham Cherian
38239	M. V. Dharaneepathy
38240	Kondur Venkata Rangam Chandrasekar Rao
38241	Sundaresan Raghavan
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38243	M. Muthusamy
38244	Subramaniam Sethuraman
38245	Venkataraman Veeraraghavan
38246	Srinivasa Ranganatha Munirathnam
38247	.Capt. Bhalchandra Balkrishna Karkhanis
38248	Srinivasan Rameswamy
38249	G. Chandrasekaran
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38252	N. Achutha Varier
38253	Srinivasa Balasubramanian
38254	Mannaickenpolayam Munisamyudayar Murugan
38255	Ramamurthysastry Chandrasekaran
38256	Pollachi Karuppusamy Chinnasamy
38257	Thandalai Radharkishan Srinivasan
38258	T. Kunjanpillai Kesava Pillai
38259	Ramasamy Venkatachalam
38260	George Varghese
38261	Karuppananservai Raju
38262	Madavi Palliyil Suresh
38263	Katteri Ranganathan Gopalakrishnan
38264	Manakkal Viswanathan Sankaran
38265	Vadangi Ramakrishna Rao

EMPLOYMENT SERVICE

This service is intended for the benefit of members of the Institution and for the Government, industrial and other organizations employing engineers. It is hoped that the employers will make full use of this service to obtain their requirement.

A small charge of Rs. 5 per insertion will be made to members for notices appearing in the 'Situations Wanted' column.

In the 'Situations Vacant' column a charge of Rs. 2 per line will be made.

Replies to advertisements should be addressed to Employment Service, The Institution of Engineers (India), P. O. Box No. 669, Calcutta 20, except where otherwise stated.

SITUATIONS WANTED

STUDENT of the Institution of Engineers (India), B.Sc., age 24 years, due to complete three years apprenticeship with a British managed power supply company in West Bengal, experienced in generation, operation and maintenance of a battery of boilers and turbo-alternators and auxiliaries, distribution, erection and maintenance of transformers up to 7.5 mVA and switchgear up to 250 mVA and overhead transmission lines and underground cables lines up to 11,000 V, and testing of meters and relays connected to a power supply system, seeks a suitable post. (Office ref. E.S. 113)

YOUNG ELECTRICAL ENGINEER having passed Section A (fully) and Section B (partly) of the Associate Membership Examination of the Institution, possessing Electrical Supervisors' Licence, Government of West Bengal, having seven years' experience in installation, operation and maintenance of equipments connected with an electricity supply undertaking, a large steel company and a rubber, plastic and chemical industry, capable of working independently requires a suitable full/part time job. (Office ref. E.S. 118)

A CIVIL ENGINEERING EMPLOYEE of Central Railway having put in a service of ten years and having passed Sections A and B of the Associate Membership examination of The Institution of Engineers (India), seeks employment in drawing office of a reputable firm in Bombay/Hyderabad/Bangalore. (Office ref. E.S. 119)

CORRIGENDA

TO VOL. 12, NO. 6, FEBRUARY 1963

Page 27, line 2: instead of 'Bombay', please read 'Calcutta'.

Page 30, line 28 : instead of 'second interview', please read 'third interview'.

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SUBODH & CO., MEERUT ROAD, ROORKEE (U.P.)

THE BULLETIN
OF
The Institution of Engineers (India)

SECRETARY & EDITOR: B. Seshadri, B.Sc., A.I.I.Sc., D.I.C., M.Sc.(Eng.), M.I.E.

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No. AGM 43

The Institution of Engineers (India)
8 Gokhale Road, Calcutta 20

April 24, 1963

In continuation of the Agenda issued with Notice No. AGM 43 dated 28th February, 1963, for the 43rd Annual General Meeting of the Institution of Engineers (India) to be held at the Puttanna Chetty Hall, Bangalore, on Saturday, May 18, 1963, at 3.00 p.m. (printed in February 1963 issue of the *Bulletin*), the following Supplementary Agenda is now issued.

SUPPLEMENTARY AGENDA

7. To consider Resolution 15 of the Council of the Institution passed at their 425th Meeting dated 20th May, 1962 :

> '*Resolved* that the Secretary's proposal for the processing of Graduateship and Studentship applications wholly in the Headquarters for the purpose of expedition be approved, and the Secretary accordingly prepare suitable revisions to the concerned Bye-laws for placing before the General Body at the next Annual General Meeting of the Institution.'*

B. Seshadri
Secretary

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* The above amendment proposed by the Council cannot be put into exact words at the present time owing to the extraordinary constitutional position.

THE HISTORY OF THE NEW BYE-LAWS*

By 1959, a feeling had grown amongst Corporate Members and the Council that the changing circumstances called for a revision of the Bye-laws. This primarily arose from fissiparous tendencies in the country to form splinter societies of engineers particularly in the smaller branches of engineering. Not everyone seemed to realize the impossibility and the undesirability of maintaining a separate organization for each branch of engineering when the members of the profession were dispersed over so enormous an area. The founders of the Institution had, for this very reason, adopted the alternative of founding an all-embracing society, incorporating all engineers, irrespective of their specialist functions.

The Council, therefore, wished to stress that the Royal Charter already provided for the promotion and advancement of the science and practice of engineering in all its branches in India. To emphasize that the fold of the Institution was wide and its membership included distinguished representatives of all branches of engineering, the Council decided that this purpose should be more specifically brought out in the Bye-laws by creating opportunities through the formation of specific Divisions of engineering for each branch of engineering which had developed to any appreciable extent in this country.

Accordingly, at the 414th meeting of the Council on 5th February, 1960, the Council appointed a Committee consisting of Maj.-Gen. Harkirat Singh (*M.*) as Convenor and Sarvashri G. K. Agrawal (*M.*), S. B. Joshi (*M.*) and N. N. Sen Gupta (*M.*), for the purpose of preparing revisions to the Bye-laws and the Regulations of the Council. While doing so, the Council stressed that these revisions should provide for adequate autonomy for each Division to ensure the growth of the various branches of engineering within the Institution.

At the 415th meeting of the Council on 20th and 21st June, 1960, Maj.-Gen. Harkirat Singh placed before the Council a draft of the revised Bye-laws. A full and detailed exchange of views between members of the Council took place at that meeting. The President, Dr. K. L. Rao, summarized the discussion that had taken place. Among the points recorded as having been agreed upon unanimously by the Council were: there should be least number of Bye-laws, and all matters not directly affecting the constitution should be dealt with in the Regulations of the Council; there should be seven Divisions, *viz.*, Civil Engineering, Mechanical Engineering, Electrical Engineering, Electronics and Telecommunication Engineering, Chemical Engineering, Mining and Metallurgy, and General Engineering; the General Council should deal with policy matters, matters of common interest, general control of the Institution, and finance; and the Division Councils should deal with technical matters pertaining to their respective Divisions.

The Committee then met in New Delhi on 20th and 21st July, 1960, and redrafted the Bye-laws based on the above. They also took into account comments and suggestions subsequently received from members of the Council. The revised draft of the Bye-laws was placed before the 416th meeting of the Council on 3rd September, 1960.

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* To keep the membership informed of the story of the new Bye-laws, the President wishes to present this note to the membership. Sent to the Press on April 18, 1963.

At that meeting, the President, Dr. Rao, once again invited each member of the Council to give his views freely. After further discussion, important modifications were approved among which were : provision should be made for the formation of additional Divisions when the number of Corporate Members in these branches reached 500, without however applying this requirement to the Divisions already agreed upon ; the Council should be constituted of the President, the two immediate Past-Presidents, Chairmen of the Local Centres, three members to be elected by the Corporate Members of each Division on an all-India basis, and 18 members to be elected by Corporate Members of the Local Centres, the number from each Local Centre being proportional to the strength of the Corporate Members at that Centre ; and an Executive Committee should be formed consisting of the President, the Chairmen of the Divisions, and three other members of the Council, with its powers defined in the Regulations. Revised procedures were also approved for the disposal of applications for membership.

The Council then directed the Committee to further redraft the Bye-laws taking into account these modifications. The Council also decided that the rewritten Bye-laws should be circulated to Corporate Members in the *Bulletin* for October 1960, and, that, thereafter, a General Body meeting of Corporate Members for the purpose of considering the revised Bye-laws should be convened in Jaipur on 26th November, 1960.

The draft new Bye-laws were printed in the *Bulletin* dated October 1960 and circulated to all members. An Extraordinary Meeting of Corporate Members was then held in Jaipur on 26th November, 1960, and the revised Bye-laws were passed with small modifications at that meeting.

As per clause 18 of the Royal Charter under which the Institution was functioning, any amendment, revocation or alteration of the Bye-laws could take effect only after the same had been approved by the Privy Council. With the constitutional changes introduced in the country on 26th January, 1950, it was not clear as to which was the authority which took the place of the Privy Council for the consent required under the Royal Charter. Therefore, in December 1960, the President, Dr. Rao, submitted the new Bye-laws to the Government of India for approval by the appropriate authority.

In the next one year, various discussions were held between the representatives of the Institution and the Ministry of Scientific Research and Cultural Affairs on the subject. The opinion of the Government representatives was, that under the Constitution of India, the Privy Council did not have any jurisdiction over the Institution of Engineers (India) and, therefore, a Parliamentary Bill for the Institution to replace the Royal Charter under which it had so far been functioning would have to be enacted. During these discussions, we were also informed that the work on the drafting of the bill was to be taken in hand shortly.

The passing of a Parliamentary Bill was also linked up with another proposal which had earlier been put up by the Government for the formation of a National Council of Engineers. This was for the purpose of bringing together various engineering professional bodies functioning in the country, to form a common organization for the co-ordination and promotion of engineering science and profession on a national level. The Government had envisaged the enactment of a bill for this purpose also. The conferences of the representatives of engineering societies and the Central Government were held in December 1959, and January 1961. The pros and cons of this proposal were also discussed by the Council and, in the end, we had informed the Ministry of Scientific Research and Cultural Affairs that the proposal as envisaged by the Government was not acceptable to us.

An opinion about the constitutional position of the Institution had previously been taken from the Attorney-General of India. The gist of the opinion was that the Institution of Engineers (India) constituted as a body corporate by the Royal Charter continued to be in the eyes of the law a body corporate, notwithstanding the changes in the Indian constitutional structure, since the grant of the Charter in 1935, and that the Charter was at the date of the commencement of the Constitution a law in force in the territory of India. A copy of this opinion was submitted to the Government in January 1962. During the discussions which followed, we urged the Government either to confirm that they agreed with the opinion of the Attorney-General, or, in the absence of this, to get us the approval of the apropriate authority so that the Institution could go ahead with the implementation of the Bye-laws which had been passed over a year earlier.

In the month of May 1962, the Institution received a letter from the Ministry of Scientific Research and Cultural Affairs saying that the Ministry of Law concurred with the opinion expressed previously by the Attorney-General of India, that after passing of the Constitution of India, there was no authority in India which could take the place of the Privy Council for the purpose of approval and consent required by the Royal Charter for amendment of the Bye-laws of the Institution. The letter further said that this did not, however, prevent the Institution from amending its Bye-laws and that such amendments, if made in accordance with its own rules, were valid and binding as if they had been approved by the Privy Council.

This letter was discussed at the 425th meeting of the Council on 20th May, 1962. Certain members suggested that, before the implementation of the Bye-laws, a ruling of the Supreme Court be obtained on the subject through a declaratory suit. This was agreed to and a resolution that the President should take steps to refer the Royal Charter to the Supreme Court for the interpretation of clause 18, as to who now takes the position and powers of the Privy Council in India, was passed.

In June 1962, the President asked Messrs Shroff & Co., Solicitors, New Delhi, for legal advice as decided by the Council. The legal advisers replied in July 1962, that they were in agreement with the opinion expressed by the Ministry of Scientific Research and Cultural Affairs, that after passing of the Constitution, there was no authority existing in India to take the place of the Privy Council and that the proviso to clause 18 of the Charter had become sterile, ineffective or nugatory and had ceased to govern or control the provisions in the main body of clause 18 of the Royal Charter. They further said that there was no manner of doubt, that in the absence of such authority the power to revoke, alter or amend the Bye-laws rested with the Institution. As regards the reference of the case to the Supreme Court, they advised that, under the Indian Constitution, it was not possible for the Institution to approach the Supreme Court direct, for the determination of the question as to which is the body which takes the place of the Privy Council, contemplated by clause 18 of the Royal Charter incorporating the Institution. They pointed out that it was for the President of India alone to refer certain matters to the Supreme Court of India for consideration and a representation, by way of a memorial, could, therefore, be submitted by the Institution to the President of India.

The President placed this legal advice before the 426th meeting of the Council on 12th August, 1962. During the discussion, it was proposed by some members that a memorial, as suggested by the solicitors, may be submitted by the Institution to the President of India. Certain other members argued that under the Constitution the President could refer a question of law or fact to the Supreme Court for consideration only if it is of such a nature and such public importance that it is expedient to obtain the opinion of the Supreme Court. The President of India had hardly ever exercised this power (*vide* Article 143 of the Constitution of India) and it was not likely that he would agree to refer this question to the Supreme Court. As this action was likely to delay the bringing into force the revised Bye-laws, they proposed against the submission of the memorial to the President. After further discussion, the Council resolved that the new Bye-laws should be adopted immediately, and that the Secretary should conduct elections to the Council in accordance with the provisions of the new Bye-laws in order that the Council thus elected could take office at the next Annual General Meeting. The Council also resolved that the present Council should carry on till the next Annual General Meeting.

Accordingly, action was initiated both at the Headquarters and at the Local Centres for conducting elections to the Council under the provisions of the new Bye-laws.

On 9th November, 1962, an ad-interim injunction granted by the Fourth Munsiff's Court at Alipore, Calcutta, was served on the Institution on the application of two Corporate Members restraining the Institution from giving effect to the new Bye-laws adopted by the Council on 12th August, 1962, till the disposal of the suit filed by these two members.

The President instructed the firm of Sandersons & Morgans, Solicitors, Calcutta, to defend the Institution. On their advice, the Secretary notified the Honorary Secretaries of all Local Centres on 15th November, 1962, to suspend all action under the new Bye-laws, including elections to the Council for 1962-63. At the same time, elections to the Council from the Divisions which were then being conducted by the Headquarters were also suspended. The 428th meeting of the Council which was to have been held in Calcutta on 9th December, 1962, and the 43rd Annual General

Meeting which was to have been held in Bangalore from February 2 to 9, 1963, were postponed by the President upon receiving the advice of the legal advisers that a position had been created by the case by which neither the old Bye-laws nor the new Bye-laws were in force. The legal advisers opined that notwithstanding the injunction order made by the Court, the Institution's Bye-laws were those which had been last adopted by the General Body of Corporate Members superseding the old Bye-laws. They said that the Court had not annulled the new Bye-laws nor relegated the Institution to its superseded Bye-laws, but what the Court had ordered was that further effect should not be given to the new Bye-laws. Accordingly, they informed that this did not mean that the Institution could bring into operation the superseded Bye-laws for the disposal of its business during the interim period, that is, until the injunction application was disposed of, without the sanction of the General Body of Corporate Members. They advised that the old Bye-laws had been superseded and the new Bye-laws made inoperative by the Court order, and it, therefore, appeared that neither set of Bye-laws was effective.

In order that the outcome of the case should be acceptable to all, the President instructed the legal advisers to apply for the transfer of the case from the Fourth Munsiff's Court, Alipore to the High Court, Calcutta, so that a ruling on the constitutional position could be had at High Court level. In the third week of December 1962, the President met the legal advisers in Calcutta and impressed upon them the urgency of getting an early decision. The legal advisers assured the President that it was very likely that the decision of the High Court would be obtained by the end of January. Based on this advice and following a meeting between the President and the President-Elect, Dr. T. Sen, held in Calcutta on the same day, it was decided that the 428th meeting of the Council be postponed to the third week of January 1963, and the Annual Convention to the last week of February 1963. A notice, in this connection, was sent to all members of the Council.

On reconsideration, however, the legal advisers revised their initial estimate of time. They informed that the decision from the High Court would take more than two months and also that the old Bye-laws having been superseded and the new Bye-laws made inoperative by the court order, there was no authority under which the Council Meeting or the Annual Convention could be held. This necessitated the cancellation of the notice sent to the members of the Council earlier.

On further study of the Royal Charter incorporating the Institution, the Secretary asked the legal advisers if the Council meetings could be held under the Royal Charter. The legal advisers agreed that it could. The President, accepting the advice of the legal advisers that both the meeting of the Council and the Annual General Meeting could be held under the provisions of clause 10 of the Royal Charter vesting all the powers of the Institution in the Council, called the 428th meeting of the Council on 17th February, 1963. At this meeting, the constitutional impasse created was discussed at great length and the Council resolved that the case should be contested as expeditiously as possible to enable the earliest implementation of the new Bye-laws. At the same time, the Council fixed new dates for the 43rd Annual General Meeting of the Institution, in Bangalore, from April 27 to May 4, 1963.

A week after this decision, the President received telegraphic messages from the Mysore Centre that owing to the World Cotton Conference which was being held at Bangalore from 24th April to 9th May, 1963, they were not in a position to make arrangements for the accommodation required for the Annual Convention. They, therefore, requested that the Convention be postponed to 18th May or 25th May as it suited the President and the President-Elect. The President-Elect left the selection of the date to the President who agreed to the postponement of the Convention to 18th May, 1963.

The Bye-laws are still under injunction and the next hearing is to take place on 23rd April, 1963. It is hoped that by the time the Annual Convention is held, the case shall have been decided.

ADDRESSES OF CHAIRMEN AT THE ANNUAL GENERAL MEETINGS OF THE LOCAL CENTRES

Assam Centre

Chairman's address by Shri K. Barua, B.E., M.C.P., M.I.E., at the 4th Annual General Meeting of the Centre on February 24, 1963

After welcoming the Chief Guest, Shri B. P. Chaliha, Chief Minister of Assam, and other invitees, Shri Barua thanked the members of the Centre for having elected him Chairman for 1962-63.

Delivering the Chairman's address, he said, 'You are all aware that the Assam Centre was established in November 1958. At that time, the Centre had only 206 members. Now at the close of the fourth year, this number has increased to 511. There are still many engineers who could be enrolled as members of the Institution and I appeal to them to join us, thus helping to create a forum for exchange of technical knowledge.

The Government of Assam have very kindly allotted a plot of land (measuring about two *bighas*) in the Panbazar area for the proposed building for the Centre. To meet the cost of this building partially, we have received a generous contribution from the Headquarters of the Institution and in our collection drive, we have been able to collect about Rs. 10,000. However, this building project will have to depend on the contributions from the Government, the industries, the business community and other sources. You will be glad to know that the Founder-Chairman, Shri H. P. Barua, of this Centre, is taking keen interest in the implementation of this project. It is needless to say that both the public and private sectors will be benefited from the Institution.

There has never been a greater need for engineers than now. It is the general feeling that the time has come when our nation has got to increase her productivity by every means known to the ingenuity of man. To make this possible, it is of utmost importance that there is a continuous supply of young men, equipped with the necessary knowledge and technical knowhow. The Coordination Committee of the All-India Council of Technical Education at its meeting in New Delhi in January 1963, recommended a few measures to meet the large demand for engineers during the emergency. The first one concerns accelerated training of students now in the third and fourth years of the degree courses by cutting out vacations so that they can complete their training, without however affecting the present syllabuses in force. The other measures suggested are (a) provision of part-time courses for preparing students for the examinations held by the Institution of Engineers (India) and other professional bodies, and (b) starting of special degree courses of short duration for diploma holders. The necessity of these two measures cannot be overemphasized. The Institution holds regular six-monthly examinations and this not only relieves to some extent the strain on the technical personnel who are being trained, but spares the financial resources of the existing as well as the newly established technical Institutions.

The good gesture shown by the authorities of the Assam Engineering Institute, Gauhati, in opening a coaching centre for Sections A and B examinations of the Institution could not survive long due to dearth of teachers and financial difficulties. We requested the State Government to help us with the necessary funds for conducting this course as it will help to produce some engineers in a short time through an 'earn and learn' programme. Moreover, a scheme may be evolved for special degree courses, with the allotment of a few seats at the Assam Engineering College, to attract deserving students from among diploma holders. There are many students in Assam, who have, through their own efforts, passed the Section A, or, even a few subjects of the Section B examination. Such students can complete the examination if they are coached properly. Steps taken in these directions will go a long way in helping the country to meet its demand for trained personnel. It is hoped that the Government will render assistance in the attainment of these objectives. Besides, the Institution, with the help of the Government, will be able to produce craftsmen and skilled labourers by arranging short courses. Training of technicians is essential for the completion of the projects which are urgently needed in view of the present situation in the country.

This State has only 8,310 miles of motorable road, maintained by the Public Works Department. Adding approximately 1,000 miles of motorable road under the local bodies, the total mileage comes to about 9,310. According to the 20-Year Road Development Plan (1961-81), to achieve a target of 22,000 miles by the end of 1981, construction of about 3,200 miles during each of the four Plan periods, commencing from the Third Plan, is required. In view of the difficult financial position, it is proposed to construct during the Third Plan 1,600 miles of motorable roads only. Of these, about 600 miles are expected to be financed by the Central Road Fund as a part of the Third Five Year Plan. In addition, it is proposed to metal and black-top 274 miles, upgrade nearly 500 miles of existing low standard roads, and complete 14 major bridges which were under construction at the end of Second Five Year Plan period. Besides these, it is proposed to undertake construction of five more major bridges, and reconstruction and strengthening of 21,000 running ft. of existing weak and temporary bridges during the Third Five Year Plan. The longest bridge undertaken by the State over the River Jia-Bharali on the north bank of the Brahmaputra was opened to traffic in August last year. This has removed a long felt want for through communication from north Gauhati to north Lakhimpur. The Brahmaputra bridge, which is expected to be opened for vehicular traffic will make possible direct communication between the south and north banks of the Brahmaputra River. This long cherished goal, when achieved, will usher in a new era in the road communication system of Assam. It may not be out of place to mention here that the successful implementation of any engineering project is dependent on the availability of engineering personnel and resources, materials, labour, etc., besides funds. In the present context, the State is lagging behind in all these aspects. Dearth of contractors for special types of works, particularly major bridges, is a stumbling block in the speedy execution of works.

Next comes the question of housing for offices, residential purposes, industries, institutions, hospitals, etc. A significant number of multistoried and other types of buildings have been constructed by the State P.W.D. The main bottleneck is inadequate supply of cement and steel, and dearth of skilled labour and resourceful contractors. Establishment of cement factories in Assam and some re-rolling steel mills will go a long way in making this State at least partially self-sufficient in cement and steel, and thereby remove a major difficulty in the way of building projects in the State.

The urgency for more engineers in Assam has never been so great as it is now. It has not been possible to fill in many positions due to dearth of qualified and experienced engineers. It is hoped that within a few years, we will be self-sufficient in our demand for engineers for various developmental works and this Centre will make a significant contribution to meet this shortage.

Summaries of Papers Published in the Journal, Vol. 43, no. 8, pts. EL 4 and GE 2, April 1963

ELECTRICAL ENGINEERING DIVISION

A Phase-Angle Meter for the Study of Swing Curve of Synchronous Machines in the Study of System Stability

M. S. Berde

Non-member

and

R. C. Pal

Associate Member

Swing curves of synchronous machines under transient conditions may be calculated by the step-by-step method. In order to determine these curves by experiments, a phase-angle meter along with a recording apparatus was used. This paper gives in detail the design, construction and testing of the phase-angle meter used for the purpose. It also explains the various difficulties involved in its adjustment. The final test results are as expected and the phase angle is measured with considerable accuracy in terms of the average readings obtained on a D.C. voltmeter.

Electronic Speed Control of Motors

B. K. Bose

Associate Member

In this paper, electronic speed control techniques for motors with special emphasis on the principles and design aspects of modern speed control circuitry are discussed.

A few practical circuits incorporating all the essential elements are illustrated. An automatic speed control circuit represents a basic close loop servo system and for the design of the circuit, stability has to be taken into account. Mathematical rigour of stability analysis has been intentionally avoided to make it presentable to the ordinary reader. The subject is gaining importance with the progressive industrialization of our country and the paper, it is hoped, may be useful to those engaged in the field.

Generalized Circuit Theory of Electrical Machines—1

C. V. Govinda Rao
Associate Member

and

R. M. Mathur
Non-member

The need for a consistent, unified approach to the historical development of electrical machine theory has been dealt with by many workers in the past. The authors of this paper feel that it is possible to develop a succinct generalized theory based on elementary principles of electric circuit analysis employing the concept of lumped parameters without encroaching upon either tensor analysis or matrix analysis. This paper attempts to present one such theory. Generalized expressions are developed for voltage and torque in a straightforward manner and the known results are abstracted from them by improving suitable constraints. While the treatment is believed to be original for the steady state, all the equations are thought to hold for transient studies as well. In the first part of the paper, the voltage equations are developed, and in the second part, the equations for torque will be discussed.

GENERAL ENGINEERING DIVISION

Anatomy of Slums

V. S. C. Bonarjee
Non-member

Slums provide cheap shelter to the poor. Slum clearance involves prior rehousing with essential amenities, minimum dislocation and rents within paying capacity. Each rehousing structure must have open breathing space around it, covering about twice its built-up area. Prior socio-economic survey should be carried out to determine the rent paying capacity, accommodation requirements and social-*cum*-economic stability for single or multistoreyed tenements. Family planning and employment decentralization should obviate growth of slums. Wards should have reserved slum clearance zones. Considering our economy, a 'vertical' density of 150 tenements per net acre in five-storeyed rehousings, without lifts, is recommended.

Ecology of Slum

S. Chatterjee

Member

Slum, being an industrial heritage, is a social fact and creates varieties of municipal, socio-economic, socio-biological housing and many other problems. Four major factors which contribute to the creation of slums are quick urbanization and heavy influx of population, obsolescence, lack of public services, and improper location of industries. Slums are classified under four main categories: (i) temporary, (ii) permanent, (iii) necessitarian, and (iv) opportunist. Quantitative and qualitative analysis of housing needs in urban areas and case studies for Calcutta and Howrah are made in this paper. The financial implication of the problem involves a sum of Rs. 3,800 crores at the present moment which will be aggravated due to increasing industrialization and consequent urbanization. Endeavours have been made by the Government for the solution of the problem through enactment and financial assistance in the form of grants and loans. The summary of the suggestions made by the Committee on Plan Projects and the recommendations and suggestions to solve this problem of slums are recorded.

Replanning and Improvement of Slums

A. K. De

Associate Member

Slums

Slums or *bustees*, as they are generally known, are a conglomeration of hutments huddled together. Almost all town and cities have these black spots. It is well known that *bustees* occupy a considerable portion of the city of Calcutta and in this paper, problems of slums with particular reference to Calcutta are considered.

Problems in Civil Engineering Construction in the Public Sector and Their Solution

B. R. Khera

Member

The requirements for the construction works must be clearly studied by the users and understood by all concerned. The objectives must be achieved with the minimum resources at minimum cost and in the minimum time. The resources of the enterprise must be maintained at their full efficiency and value. For every enterprise, there is an optimum size. Because under or oversize involves payment some sort of penalty, every endeavour should be made to reach the optimum size as soon as possible. This naturally requires the maximum of reforms in the minimum time. No enterprise, even when it has reached the optimum size, is conducted in the best possible manner. Hence a constant endeavour must be made to lower the work content of each process and the cost of all the products to achieve the maximum profit.

Roots of Slums in Modern Cities

Prof. G. K. Parnikar

Non-member

This paper deals with the historical studies of the growth of slums. The growth has a historical significance in terms of time and space. The growth of cities is analogous to the growth of trees. The seed, the soil, the roots, etc. can be compared with the processes of mechanization, industrialization and urbanization which have been instrumental to the birth and growth of cities. Rapidity of growth and uncontrolled overcrowding and congestion have been the cause of slums. The roots of slums are interwoven with the roots of cities and the remedy lies in studying the anatomy of towns and cities in respect of the anatomy of slums.

Role of Urban Health Centre, Chetla, in the Improvement of Sanitation of Slums

S. Subba Rao

Associate Member

Slum clearance and rehabilitation of excess population of slums are the only acceptable long term solutions to the problem of slums in urban areas. Since this plan envisages heavy expenditure and takes a long period to fulfil, slum improvement, wherever feasible, can be taken up as an interim measure only. More than one-third the population in the Chetla area in Calcutta is living in slums. An Urban Health Centre under the All-India Institute of Hygiene and Public Health, Government of India, is functioning in this area. This centre is actively engaged in the health and sanitaton problems of the slum dwellers in the area. This paper briefly discusses the problem of sanitation and housing in these *bustees* as revealed by several surveys conducted by the Centre, and the efforts it has put in to improve these conditions, working in close collaboration with the Corporation of Calcutta.

NUCLEAR ENGINEERING GROUP

Problems on Nuclear Power Station Construction

S. K. Biswas

Associated Member

The construction of a nuclear power station places new demands on industry. For instance, the high quality pressure vessel has to be fabricated on the site because of its enormous size. Of all the exacting requirements associated with the works, the civil engineering works need special attention for achieving a high degree of accuracy and quality in massive concrete construction, as also the detailed interlocking of buildings and engineering plant installations. The construction of the reactor core using new materials provides a new experience, and the cleanliness required is novel to the field of engineering. During the process of nuclear power station construction, various types of complicated problems will have to be faced. The problems are of an individual nature and it is, therefore, not possible to give details of all the problems involved. However, special attention is given in this paper to explain the major problems which were encountered during the construction of a gas cooled graphite moderated reactor.

INSTITUTION NEWS

Publication and Supply of the Public Health Engineering Division Part of the *Journal* from June 1963

A separate Division Part of the *Journal*, exclusively devoted to the publication of papers in the field of public health engineering will be issued beginning with its first number in June 1963. This Part will be published three times a year—in February, June and October. Effective June 1963, the Civil Engineering Division Part of the *Journal* will not contain, as hitherto, papers on subjects coming under the perview of public health engineering.

As members are already aware, in accordance with the revised scheme of publications introduced in June 1961 (and notified in the *Bulletin*), each Corporate Member and Graduate will receive without payment only one Part of the *Journal* of his choice and a single copy of that Part will be mailed to him free, as and when published. Additional Part/s, if desired, will be supplied on payment of subscription at the current rates in force for Institution publications, as already detailed in the *Journal* Distribution card attached to the *Bulletin*.

Members who wish to register their names for the supply of the Public Health Engineering Division Part of the *Journal* from June 1963 without payment are requested to inform the Membership Officer at the Head Office of the Institution, in writing on or before June 4, 1963, confirming their choice to receive this Part free of cost, also at the same time confirming that the supply of the Civil or any other Division Part of the *Journal* they are receiving so far without payment may be discontinued.

Unless this confirmation is received by the specified date, the supply of the *Journal* to members will be continued as at present (as indicated on the *Journal* Distribution Card filled by the member himself previously) without regard to complaints on non-receipt of the Public Health Engineering Division Part of the *Journal* from June 1963.

Award of prizes for 1960-61

The following prizes have been awarded for the year 1960-61.

(1) *The President of India's Prize*

This prize has been awarded to Shri D. Mookerjea (*M.*), for his paper entitled 'The Kosi— a Challenge in River Control' published in the *Journal*, vol. 42, no. 3, pt. CI 2, November 1961. Shri Mookerjea is Chief Engineer, Kosi Project, Patna.

(2) *The Union Ministry of Irrigation and Power Gold Medal and Cash Award*

The prize has been awarded to Sarvashri K. Seetharamiah (*M.*) and A. S. Rama Murthy (*Non-member*), for their paper entitled 'Hydraulic Jump Stabilization' published in the *Journal*, vol. 42, no. 7, pt. CI 4, March 1962. Shri Seetharamiah is Assistant Professor, Power Engineering Department, Indian Institute of Science, Bangalore, and Shri Rama Murthy is a Research Student in the same Department.

(3) *The Railway Board First Prize*

This prize has been awarded to Dr. C. V. S. Ratnam (*A.M.*) for his paper entitled 'Utilization of Non-Coking Coals for Iron and Steel Making', published in the *Journal*, vol. 41, no. 11, pt. MM 1, July 1961. Dr. Ratnam is Chief Chemist, Neyveli Lignite Corporation, Neyveli.

(4) *The Railway Board Second Prize*

This prize has been awarded to Shri B. V. S. Rao (*A.M.*) for his paper entitled 'Special Features of 25 kV A.C. Electric Traction with Particular Reference to Ignitron Locomotive', published in the *Journal*, vol. 42, no. 2, pt. EL 1, October 1961. Shri Rao is with the Main Line Electrification Project, Eastern and South-Eastern Railway, Calcutta.

(5) *Institution Prize*

An Institution Prize has been awarded to Dr. A. K. Chatterjee and Sarvashri K. V. Ramanan (*Non-member*) and B. S. Rao (*Non-member*), for their paper, entitled 'Supressor Grid Controlled Voltage Stabilizer', published in the *Journal*, vol. 42, no. 5, pt. ET 2, January 1962. Dr. Chatterjee is Principal, Birla Institute of Technology, Ranchi, and Sarvashri Ramanan and Rao are with the Birla Institute of Technology, Pilani.

(6) *Institutian Prize*

An Institution Prize has been awarded to Shri S. N. Das (*A.M.*), for his paper entitled 'Batch Production under Piecework System', published in the *Journal*, vol. 41, no. 12, pt. GE 1, August 1961. Shri Das is Civilian Technical Adviser, Directorate of Naval Armament Inspection, Naval Headquarters, New Delhi.

(7) *Prize for the best article on 'Hydraulic Similitude' awarded by the Public Charitable Trust for the Advancement of Engineering Education*

This prize, donated by Dr. K. L. Rao (*M.*), Past-President, has been awarded to Shri M. M. Dandekar (*A.M.*), for his paper entitled 'Hydraulic Similitude'. Shri Dandekar is Lecturer in Civil Engineering, Walchand College of Engineering, Sangli.

INSTITUTION NOTICES

Supply of marksheet to candidates appearing in the Institution examinations

The Council of the Institution has decided that hereafter candidates appearing for the Institution examinations will be supplied marks along with the results free of charge.

This practice will be effective from the May 1963 examinations. Candidates who have paid fees for receiving marks for the May 1963 examinations in advance may now write to the Accounts Officer of the Institution for obtaining refund of the amount.

The Council of the Institution has decided that candidates who have passed Sections A and B of the Associate Membership Examination or are exempted therefrom in a branch of engineering will be allowed to appear for another complete branch of engineering in Section B, and on successful completion of the entire Section will be certified that they have passed in that additional branch of engineering. It has also been decided that the rules of examination for this category of candidates will be identical with those for regular candidates appearing for Section B Examination.

Draft Indian Standard

The following draft Indian Standard has been Issued recently

Draft Indian Standard Code of Practice for Use of Steel in Overhead Transmission Line Towers Part I—Loads and Permissible Stresses—Doc : SMBDC 7.

This code stipulates the various design assumptions to be adopted in the design of transmission line towers for overhead transmission line at 66 kV and above.

Members may send their comments on the above Standard before June 25, 1963, to Shri D. C. Sharma (*M.*), 4-E, Section 9-C, Chandigarh, Punjab, who is the Institution representative on the Sectional Committee dealing with this Standard.

Copies of the draft Standard may be obtained from the office of the Indian Standards Institution, 9 Mathura Road, New Delhi; or from its branch offices at 232 Dr. Dadabhoy Naoroji Road, Bombay 1; 11 Sooterkin Street, 3rd Floor, Calcutta 13; 2/21 First Line Beach, Madras 1; or 14/69 Civil Lines, Kanpur.

Publications of the Institution of Chemical Engineers, London

Under reciprocal arrangements between this Institution and the Institution of Chemical Engineers, London, members of the Institution will be allowed to purchase the *Transactions* and other publications of the Institution of Chemical Engineers at a discount of 20%. Members can also purchase special publications of the Institution of Chemical Engineers at members' rates. Members of the Institution of Chemical Engineers, London, will enjoy similar privileges in regard to purchase of the *Journal* of the Institution and other publications. The Institution has similar arrangements with other Commonwealth Institutions.

Any member of the Institution intending to visit the U.K. and wishing to exercise or explore some chemical engineering interest will, on being introduced, be given all the privileges of membership of the Institution of Chemical Engineers (with the exception of the right to vote at Corporate Meetings) for a period not extending nine months at any one time. Cooperation will also be extended to him including availability of publications, invitation to technical meetings, use of the library, and participation in any other activities within the objects of the Institution of Chemical Engineers.

Film Shows on 'Planet Earth', by the U.S.I.S., Calcutta, June 1963
(For Calcutta members only)

The United States Information Service, Calcutta, has offered a series of film shows to the members of the Institution residing in Calcutta beginning June 1963. The programme will begin with 13 popular scientific films in colour entitled 'Planet Earth Series.' Three of these films, each running for 27 min., will be shown at each programme. All showings will start at 6.00 p.m. in the U.S.I.S. auditorium, 6 Chowringhee Road.

Members who wish to attend these films shows are requested to fill in a coupon as detailed below and **mail it directly** to the United States Information Service, 7, Chowringhee Road, Calcutta 13. Printed copies of the coupon can be had from the Superintendent, Bengal Centre.

Audio-Visual Officer,
United States Information Service,
7 Chowringhee Road,
Calcutta 13

I wish to attend the film showings at the U.S.I.S. auditorium announced in the *Bulletin of the Institution of Engineers (India)*. The day of the week most convenient to me is ....

Signature

Name (in block letters)

Address

FORTHCOMING CONFERENCES

Symposium on 'Steam Power Station',
sponsored by the *Indian Journal of Power and River Valley Development*, 1964

A Symposium on 'Steam Power Station', sponsored by the *Indian Journal of Power and River Valley Development* in cooperation with the power authorities and specialists in India will be held in early 1964. The venue of the symposium will be announced later. Shri S. S. Kumar formerly Chairman, Central Water and Power Commission, and now Director-General, Technical Development, Ministry of Economic Affairs and Defence coordination, Government of India, is the Chairman of the organizing committee.

The idea of organizing the symposium was born out of a realization of the paucity in India of adequate information on modern steam power stations. On the other hand, plants generating thousands of megawatt of electrical energy are being installed each year, the target for power at the end of the Third Five Year Plan (1961-66) being 13 million kW. At the present development rate, it is likely to continue to double-up every five years. A substantial part of this will be steam power. There is thus an extensive field and any contribution which the symposium may be able to make in the advancement of the knowhow of steam power will assist the country.

The subjects proposed to be discussed in the symposium are: (i) Steam Power Field in India; (ii) Steam Cycle; (iii) Equipment for Steam Generation; (iv) Equipment for Power Generation; (v) Equipment for Electrical Systems; (vi) Equipment for Fluid Handling; (vii) Equipment for Heat Exchange; (viii) Equipment for Instrumentation and Control; (ix) Architecture and Civil Design: and (x) Managing of Plant—Construction and Operation.

Further details of the Symposium can be obtained from the *Indian Journal of Power and River Valley Development*, 6/2 Madan Street, Calcutta 13.

Symposium on 'Bearing Capacity of Piles', Central Building Research Institute, Roorkee, February 1964

A Symposium on 'Bearing Capacity of Piles' will be held in February 1964 at Roorkee under the auspices of the Central Building Research Institute, Roorkee. The subjects of the symposium include (i) Site Investigation for Pile Foundation, (ii) Load Bearing Capacity of Piles, (iii) Design of Pile Foundations, (iv) Settlement Studies, (v) Short-Bore Piles, and (vi) Constructional Aspects. Members who are interested in presenting papers may forward them to the Director, Central Building Research Institute, Roorkee, not later than October 31, 1963.

International Conference on State of Stress in the Earth's Crust, California, June 13-14, 1963

This conference is intended to establish communication among the many scientific disciplines interested in the new science of rock mechanics. It will try to determine the present state of the art and future directions for research in this field. By providing a much needed clearinghouse for information on current work, the conference will help to coordinate efforts among the disciplines that now have an interest in rock mechanics. These disciplines—for whose members the conference has been planned—include physics, mathematics, engineering (civil, mining, mechanical, and petroleum), geology, and geophysics. The conference is expected to discuss rock mechanics problems involved, for example, in the design of underground chambers, development of petroleum production at great depths, stabilizing of deep open cuts in rocks, and measurement of such rock mechanics phenomena as residual or primary stresses in the crust. There also will be discussion on how different sciences can be used to advantage in design and research projects involving rock mechanics. The *Proceedings of the conference* will also be published.

Further details may be had from L. W. Johnson, The RAND Corporation, 1700 Main Street, Santa Monica, California, U.S.A.

Symposium on 'Catalysis in Practice', Institution of Chemical Engineers, London, June 20-21, 1963

Many modern chemical processes and industries are based on the use of catalysts, and catalytic operations have been intensively studied for more than a century. To date, however, no generally accepted theory of catalysis has evolved and the practical applications of catalysis are thus frequently regarded as being confidential.

The Institution of Chemical Engineers, London, who have arranged this symposium, will bring together a group of papers which cover a wide field of applications of catalysis in practice. Like scaling-up, the practical application of catalysis to modern industry is a fundamental part of the skill of the chemical engineer. There is thus no need to stress the importance of this symposium.

The symposium will be held at the Royal Hall, Harrogate, from June 20 to 21, 1963. The following papers will be read and discussed.

1. 'Selective Hydrogenation of Acetylene in Ethylene Made by the Steam Cracking Process' by J. A. L. Spiers
2. 'Molybdena Catalyst Deactivation: the Problem and Its Solution' by L. Broussard, K. E. Draeger and A. B. Welty
3. 'Problems in the Development of Cobalt Molybdenum Catalysts' by E. B. Andrews
4. 'Development and Performance of Catalysts for the Desulphurization of Distillates' by F. W. B. Porter and E. C. Housam
5. 'Fluid Cracking Catalysts—Their Activity and Stability' by R. G. F. Fowler and F. Emerson Ivey (Jr.)
6. 'The Removal of Carbon Monoxide from Fuel Gases' by J. D. F. Marsh and R. Robson
7. 'Catalytic Hydrogenation of Glucose to Sorbitol Using a Highly Active Catalyst' by M. A. Phillips
8. 'Computer Optimization of Sulphuric Acid Convertor Design' by R. H. Fariss
9. 'Vanadium Catalysts in the Manufacture of Phthalic Anhydride' by A. Saffer
10. 'The Catalytic Dehydrogenation of Iso-Propanol on Zinc Oxide' by W. M. Crooks and T. Guha
11. 'Development of Fischer-Tropsch Catalysts for Slurry-Phase Synthesis' by D. Gall and T. A. Dorling

Written contributions to the discussion will be accepted for consideration for publication up to July 21, 1963. Further details can be had from the General Secretary, The Institution of Chemical Engineers, 16 Belgrave Square, London, S.W.1.

Symposium on 'Automatic Production in Electrical and Electronic Engineering', London, October 24-25, 1963

The Institution of Electrical Engineers, London, will hold a symposium on 'Automatic Production in Electric and Electronic Engineering, in connection with the National Productivity Year in October 1963.

The subjects proposed to be included in the programme are : (i) Design of Components for Automatic Assembly, (ii) Automatic Functional Testing of Electrical Components and Assemblies, (iii) Automatic Production Processes, (iv) Automatic Assembly, (v) Automatic Inspection and Testing, (vi) Automatic Adjustment, (vii) Automatic Production Scheduling and (viii) Automatic Storage and Distribution.

The written material for the Symposium will comprise contributions between 1,000-1,500 words and authors desiring to offer written material are required to send the suggested titles and an outline not exceeding 200 words to The Secretary, the Institution of Electrical Engineers, Savoy Place, London, W.j 2, from whom further details can also be had.

BOOK ACKNOWLEDGMENT

Domestic Architecture. B. L. Dhama. *Published by the author. Swastika House, Station Road, Jaipur*, Rs. 6.00. 26 pages.

This book deals in general with the architectural aspects of building houses based on Hindu beliefs. It explains the principles involved in planning, choice of settlement, layout, modern houses and buildings, etc., illustrated by a number of plates. The book is available at the above address.

CORRIGENDUM

TO VOL. 12, NO. 6, FEBRUARY 1963

Page 21, Line 4 : Please delete 'O.R. Narayanaswami Aiyar'

EMPLOYMENT SERVICE

This service is intended for the benefit of members of the Institution and for the Government, industrial and other organizations employing engineers. It is hoped that the employers will make full use of this service to obtain their requirement.

A small charge of Rs. 5 per insertion will be made to members for notices appearing in the 'Situations Wanted' column.

In the 'Situations Vacant' column a charge of Rs. 2 per line will be made.

Replies to advertisements should be addressed to Employment Service, The Institution of Engineers (India), P. O. Box No. 669, Calcutta 29, except where otherwise stated.

CALCUTTA UNIVERSITY
CENTRAL LIBRARY

THE BULLETIN
OF
The Institution of Engineers (India)

SECRETARY & EDITOR: B. Seshadri, B.Sc., A.I.I.Sc., D.I.C., M.Sc.(Eng.), M.I.E.

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OPTIMUM USE OF AGRICULTURAL LAND AND IRRIGATION WATER

K. N. Lal
Associate Member

Introduction

It is a paradox that India, primarily an agricultural country, has to depend upon huge import of food grains just to feed its inhabitants at the lowest level of required calorific value. The bulk of import has also been increasing, and this went upto 50.56 lakh tons in 1960-61 against 31.73 lakh tons in 1958-59. The Food Minister of Bihar announced the other day that 'inspite of all concerted efforts and intensive planning, Bihar will be deficit in food even by the end of the Third Five Year Plan, *i.e.*, by 1965-66. In Bihar, we expect to produce 87.27 lakh tons of food grains against the requirement of 88.66 lakh tons by that time.

The small countries in western Europe are self-sufficient in food even with the population density of 900 persons per sq. mile, and that too with only 27.9% of total land under agriculture. They are still able to keep 7.3% of their land as forest, 38.7% as pasture, and 3.7% under fruit cultivation. They afford to grow even flowers in hundreds of acres of land though mostly for export purposes. How is this possible ?

If we look into it, we find that there are two basic factors which stand in our way of being self-sufficient. These two factors are (i) food habit, and (ii) improper use of land.

The first handicap, the food habit has a defeating effect, and perhaps, we may become surplus in food within a year if we radically change our food. The habit of depending on rice and wheat only as staple diet should not be accepted as such in the present context of affairs. Potato and other vegetables not only give yields several times, even 10 to 20 times that of rice and wheat, but also can be grown several times a year in the same plot. So, we may consider substituting our staple diet, at least partly, with these.

Also, the improper use of land should be discouraged by all means.

Optimum use of land

The two main enemies of our agriculture are drought and flood. The uncertainty of the monsoon rains has been causing much hazards. It more often betrays us in the hour of need and forces us to be satisfied with whatever meagre output we get from the fields. The flood ravages, on the other hand, are even worse. These take toll of many human and cattle lives, leaves millions of people homeless and obliterates all efforts for raising the standard of living. The magnitude of loss these forces of nature have been causing is so well known that it needs no elucidation. These have to be fought vigorously.

Apart from the above two crippling hazards, much damage to the agricultural yield is caused by water-logging, plant diseases, absence of manures, improper supervision of scattered and small holdings which are damaged by stray animals, birds, and bad elements of society, and last but not least, by unscientific utilization of land, *i.e.*, by absence of knowledge of the type of plant to be grown on a given type of soil.

The drought and flood can be avoided by providing a well planned perennial irrigation system and a network of drainage systems. This is being attempted by the River Valley Projects Department in various regions in Bihar. The Saharsa and Purnea Districts have already been feeling secure by the flood control measures achieved so far. The drainage system, in these regions, will come up along with the irrigation system to be undertaken.

The above developments in Bihar provide an ideal picture of the optimum utilization of the agricultural land. Now people should rise up to the occasion and pool up their resources along with government agencies such as Block Development Organization, Revenue Department, Agriculture Department, etc., and this can be done by adopting the following steps :

(i) Providing a well planned village irrigation channel—*i.e.*, water courses planned to suit the standard sizes and holdings, preferably a rectangular one of size 800 yd. × 150 yd.;

(ii) Providing a well planned network of drainage system with the field drains, draining through subsidiary drains into trunk drains. (Small regulation works, planks or *kaddies*, may even be provided in drainage systems with a view to hold some water at times of need preventing abnormal lowering of ground water level and complete desication);

(iii) Parcelization of land holdings, fitting in irrigation and drainage system by consolidation of holdings. Standard sizes of holdings may be 800yd. × 150 yd., *i.e.*, approximately 25 acres, having water courses at one end and field drains at the other. These may belong to one or more persons, as the case may be, each having land at one consolidated place. One dimension being 150 yd., the other may vary according to the total land belonging to an individual which is summed up together at present;

(iv) Effecting field drainage by subsoil flow, tile drainage, etc., preventing the land totally from soil erosion. This will also free the land from waterlogging and consequent salinization which is apprehended in this region of high phreatic surface after constant irrigation; and

(v) Providing *katcha* roads leading to the fields, and developing other means of communication. The *katcha* farm roads can run along the water courses in each case, making each farm easily accessible.

Maximum supervision can be provided if the holdings are consolidated and each farmer has his entire land in one block. He can devote his full time there, providing fence, etc., and thereby reducing damages to a minimum. He can take advice of the agronomists posted in rural areas for improvement of soil structure as well as for the plantation of the most useful plants in the particular soil. He can, with the help of assured irrigation and drainage, plan for cattle breeding, dairy farming, or fruit production which will result in various rural industries based on these products. The problem, hence, boils down to provision of holdings at this stage, so that attempt is made to provide the water courses meant for irrigation as one boundary of individual land holdings, the other boundary of this land being the drainage channels draining the water in case of excess rain, etc., to trunk drains through subsidiary drains and therefrom to the river.

The consolidation of land holdings can be effected either by Government legislation, or by forming some cooperative societies, or public boards, comprising of several villages and effecting works enumerated above in consultation with the project engineers. The money available with the Block Development Organization, the Agriculture Department, Local and District Boards, Cooperative Department, etc., meant for such works, combined with public cooperation will suffice for the present. The best investment of the available money can be done if such work of permanent utility is taken up in time. The execution can be done either by the cooperative society itself or by the project engineers diverting the above fund to the project.

There had been, in the past, objections to any attempt of land consolidation and its parcelization in economic units. But the reason can very well be appreciated. Land owners struggling in uncertainty of monsoon rain and apprehensive of impending floods were afraid of consolidation of land at one place for fear of losing the entire yield in case of even minor calamity in that region. Now the context has totally changed. Not only the flood control measures, but perfect drainage systems and perennial irrigation networks are being provided to entire cultivable land in a particular region. Hence, there should not be any objection for such an attempt, if taken up judiciously.

It is needless to stress the utility of such a planned implementation of land use. The reorganization and reorientation of the entire rural living as suggested above will enthuse confidence in people and evoke their interest in their land, which with the use of irrigation measures and with the advice of agronomists, will result in higher yield. The system will provide a method of optimum utilization of water on which such a heavy capital is being invested with the hope of better returns. Moreover, the very soil structure can be improved by having so much control on water. Manuring and advice of experts in manuring are of use only if a proper basis as, laid down above, is made available. The re-orientation, thus affected, is certain to yield better results.

ADDRESSES OF CHAIRMEN AT THE ANNUAL GENERAL MEETINGS OF THE LOCAL CENTRES

Orissa Centre

Chairman's address by Shri S. S. Behera, M.I.E., at the 4th Annual General Meeting of the Centre on February 24, 1963.

After welcoming the Chief Guest, Dr. A. N. Khosla, M.I.E., Governor of Orissa, and other invitees, Shri Behera thanked the Committee of the Centre for electing him Chairman for 1962-63.

Delivering the Chairman's address, he said, 'Apart from being the annual event, there is an added significance in today's meet as it marks the foundation of a new building of its own for the Centre. Of still greater significance is the presence amongst us all an engineer of the outstanding eminence of Dr. A. N. Khosla. With this very Institution which is the highest professional body in the country, Dr. Khosla has been closely associated for over 41 years and was elected its President for 2 consecutive years, an honour unique in itself. Today he graces the office of the head of this State, which, he is also the first engineer to have done so in any State of India. I have no doubt that blessings and guidance of Dr. Khosla will help this young branch of the Institution to grow in strength and importance in the years to come.

The Orissa Centre of the Institution started only four years ago in 1959. During this short period it has made much headway. The membership has risen from 332 at the start to 718 at present comprising engineers drawn from all branches of engineering. The new building for the Centre, the foundation stone of which has just been laid, is estimated to cost Rs. 5 lakhs. The Headquarters of the Institution has given an initial grant of Rs. 50,000 for construction of the building. Shri Biren Mitra, Deputy Chief Minister, Government of Orissa, who was the Chief Guest of the last Annual General Session of this Centre announced in course of his address that the Government would favourably consider giving financial aid to the extent of Rs. 5 lakhs for the construction of this building. The Institution places on record its deep appreciation for the very generous offer made by the Deputy Chief Minister. The members will be glad to know that this matter is receiving very favourable and active consideration of the Government, and it is expected that a lakh of rupees will be placed at our disposal during the current financial year. A plot of land measuring 1.46 acres has already been allotted by the Government. We sincerely hope that the Government will be kind enough to give us this land free of cost.

We are in the second year of the Third Five Year Plan. The Plans which are designed to make us strong economically and at par with other progressive countries of the world, have now become much more urgent and important in view of the national emergency through which we are passing at present. The responsibilities and burden of planning, construction and maintenance of projects fall on our profession. The engineers will be directly or indirectly responsible for the expenditure of 62% of the total plan investment of the Third Plan as envisaged before the present emergency. If we take the work of our professional brethren in the defence services into account, this figure would perhaps be substantilly higher. It would be of interest to recapitulate at this point all that has been done so far in this State, especially, in the field of engineering and to mention the Plans in hand.

It is impossible to have proper development of the country without an adequate network of roads. Out of a proposed outlay of Rs. 7.5 crores for development of roads during the Third Plan, a sum of Rs. 2 crores has been spent during the first year, and Rs. 2.2 crores are expected to be spent by the end of the second year. This expenditure will result in the achievement of a physical target of improvement to 352 miles of roads and completion of 39 bridges. Over and above the Plan outlay, the Finance Commission of the Government of India have given a special grant of Rs. 7.5 crores to be spent on road development in this State during the the Third Plan period. Of this, a sum of Rs. 1.61 crores is expected to be spent during the current financial year. The physical targets proposed to be achieved out of this expenditure are improvement to 205 miles of roads, construction of 14 bridges, and construction of 10 miles of new roads. Two very important major bridges, one over the river Brahmani near Talcher on the Cuttack-Talcher-Rourkela Road costing Rs. 74 lakhs, and the other over the river Subarnarekha near Rajghat on the Cuttack-Balasore-Calcutta Road costing Rs. 56 lakhs, are being constructed out of this grant. The construction of these two bridges, which are expected to be completed before June 1965, will provide direct short-cut all-weather communication from Cuttack to Rourkela and from Cuttack to Calcutta, respectively.

Besides the above, two very important major road projects, namely, the National Highway Project and the Expressway Project are under execution.

The National Highway Project, which envisages the improvement of the 168 miles stretch of National Highway No. 5 from Cuttack to Bihar border, *via* Baripada, and construction of eight major bridges, is being financed by a loan assistance given by the International Development Association of the World Bank. The construction of the Mahanadi and Birupa bridges is in progress. The construction of Brahmani and Kharsuan bridges has just been taken up, and that of the Baitarani bridge is expected to be taken up shortly. Earthwork for widening the road to 38 ft. and collection of materials for the pavement has been taken up throughout the road. The entire project is scheduled to be completed by September 1964.

The Expressway Project, which envisages the construction of an expressway from Daitari mines to the Paradeep port for transporting iron ore, is estimated to cost Rs. 14.72 crores. The present proposal is to have to two-lane highway with a formation width of 38 ft. and a single-line railway from Haridaspur to the port on the same alignment and on a common embankment. Roadwork is in progress in the upper reaches where lands have been acquired. One important feature of this project is that earthwork is being executed mostly through labour cooperative societies. The construction of a major bridge across the Brahmani river near Kabatbundh has been taken up. The construction of the two major bridges across the Mahanadi river near Paradeep and Nuna river near Marshaghai has been entrusted to the Orissa Construction Corporation. The construction of two other major bridges across the Birupa and Badagenguti rivers is expected to be taken up during the current working season. It is proposed to export 2 million tons of iron ore annually in the initial stages. This quantity is expected to increase to 10 million tons annually in later stages. Besides, providing transport facilities for this, the expressway will also open up large tracts of flood affected areas. This project is scheduled to be completed by October 1965.

The establishment of an all-weather port at Paradeep is another very important scheme which has been taken up for execution. The first stage of the work provides for one ore berth and one cargo berth including turning circle, entrance and approach channels. In the final stage it is proposed to construct 19 cargo berths for handling 3 to 4 million tons of general cargo, three iron ore loading berths for carrying 10 million tons of iron ore and an oil dock with two jetties. The first stage of the project is estimated to cost Rs. 12.32 crores. Preliminary works have since been taken up.

There has been remarkable progress in the field of irrigation during these years. The Hirakud Dam Project was the first major scheme taken up after independence in Orissa. This project created a potential of 6,00,000 acres in Sambalpur and Bolangir Districts in addition to releasing 10,000 cusec. of regulated flow from the turbines. The existing Orissa canals and Rushikulya system are irrigating about 4,30,000 acres annually. An additional potential of 14,08,000 acres will be created in the delta on completion of the Delta Scheme. Two more major irrigation schemes, namely, over the Salandi and the Baitarani rivers are now under construction and these two schemes will irrigate 5,51,300 acres annually on completion. Construction of eleven medium schemes is to be taken up during this plan period of which work on eight schemes is now in progress. All these schemes will create a gross potential of 2,27,400 acres on completion. Thus the major and medium schemes taken up till date after independence will create a gross potential of 27,86,700 acres.

Flood control is a very serious and complex problem facing this state. The Mahanadi, Brahmani and Baitarani systems are the causes of all major floods. Every year in the deltaic areas there is a great devastation due to these floods. The question of flood control has therefore been receiving pointed attention of the Government. A dam across Mahanadi at Tikarpara is under investigation, and once this is constructed floods in the Mahanadi delta will be completely under control. The construction of similar high dams across the Brahmani and Baitarani rivers is also under investigation. In the Third Plan there is a provision of Rs. 330 lakhs for flood protection measures. An expenditure of Rs. 35 lakhs was incurred in the year 1961-62, and Rs. 55 lakhs are likely to be spent during the current year.

Under the National Water Supply and Sanitation Programme of the Government of India, Urban Water Supply schemes to different towns of the State have been taken up. So far water supply projects in the five towns, namely, Cuttack, Sambalpur Rayagada, Parlakhimidi and Phulbani have been completed and temporary water supply in the three towns namely, Jharsuguda, Barbil and Balasore have been effected. It is expected that an amount of Rs. 150 lakhs will be available for expenditure during the Third Plan by which minimum drinking water facilities will be made available to 15 more towns in the State. The total urban population that will be benefited by protected water supply will be about 2.60 lakhs only out of the total urban population of 11.60 lakhs in the State.

There is no town in the State except the new capital Bhubaneswar where a comprehensive sewerage system exists. The Cuttack sewerage scheme has been taken up since the middle of the Second Plan period at an estimated cost of Rs. 232 lakhs.

No surface drainage was provided for in any of the towns of the State during the First and Second Five Year Plan periods. The Cuttack drainage scheme has been taken up during the Third Five Year Plan period at an estimated cost of Rs. 103 lakhs. Besides this, drinking water supply schemes for villages have also been taken up, and the UNICEF have kindly agreed to render assistance in respect of some of these schemes by supply of pipes and pumps.

The programme of power development has been given priority in the Third Plan and accordingly the State Electricity Board have made a provision of Rs. 18.76 crores for expenditure during this period. Besides the continuing schemes from the Second Plan which includes Hirakud Stage II, six new schemes are to be taken up during this period. Of the new schemes, mention may be made of the Rural Electrification Scheme, Thermal Power Station at Talcher, and Balimela Hydro-electric Project.

Under the Rural Electrification scheme, an outlay of Rs. 141 lakhs is envisaged in the Third Plan. It is expected that 165 villages would be electrified with this amount. Out of the 307 *Panchayat Samiti* headquarters in the State, 80 have been electrified upto the end of the Second Plan. It is proposed to electrify all the *Samiti* headquarters by the end of the Fourth Plan.

The Third and Fourth Plans provide for increase in the power generation at Hirakud to 147 mW. Further, additional power will be generated at the Talcher Thermal Station to the extent of 250 MW in the Third Plan and an equal amount in the Fourth plan. Power from Balimela Project which is expected to be available early in the Fourth Plan will be of the order of 360 MW. As power from these schemes becomes progressively available, construction of transmission lines will be necessary for proper utilization of the power. For the construction of these lines an outlay of Rs. 543 lakhs is envisaged during the Third Plan period.

The Balimela Hydroelectric Project is another very important scheme which has been taken up for execution recently. This project envisages the construction of a high dam across the river Sileru near the village Kondakamberu in Malkanagiri subdivision of Koraput District. It has been agreed upon by the State Governments of Orissa and Andhra Pradesh that the cost of the dam will be borne equally by them, and that the water available at the dam site will also be shared equally by the two States. The Andhra Pradesh Government will draw their share of the Sileru river from the reservoir and generate power at the dam site at Guntawada. The Orissa Government will draw her share through a tunnel across the high ridge on the right bank of the river and generate power near Balimela. A head of about 950 ft. is available for generation of power.

Orissa's share of water will be utilized in Potteru valley for irrigation after generation of electricity at Balimela Power House. It is estimated that about 2,100 cusec. of water will be available as Orissa's share to generate 240,000 kW of power at Balimela Power House, with 60% load factor. The dam is estimated to cost Rs. 24 crores and the power portion of Balimela Project will cost Rs. 26.45 crores to Orissa. This project is now under execution.

With a view to cater technical advice and supervision to the *Panchayat Samities* in the state for the execution of development works and for investigation and execution of irrigation schemes, an organization known as Rural Engineering has been set up by the state. A chief engineer with one division in charge of an executive engineer is in each of the 13 districts, of the State. This organization is in charge of execution of all minor irrigation projects costing upto Rs. 10 lakhs, execution and technical supervision of all roadworks not undertaken by the P.W.D., and construction and maintenance of all buildings under the control of the Revenue Department besides primary health centres and granaries.

This session is being held during a National Emergency. As in peace, so also in war, the engineering profession has a very great vital and noble role to play. We must be prepared to implement any programme for national defence with speed and efficiency. I have no doubt in my mind that the engineers of this State would fully rise equal to the occasion and discharge their responsibilities with honour to themselves and to the country'.

Summaries of Papers Published in the Journal, Vol. 43, no. 9, pts. CI 5, ME 5, & ET 3, May 1963

CIVIL ENGINEERING DIVISION

Expansive Sub-Critical Flow in Open Channel Transitions

R. S. Chaturvedi

Non-member

In spite of extensive and increasing use of flumed structures for conveyance of water in open channels, the design of rational transitions in expansive flow has withstood every effort towards a general solution. It remains an unsolved problem in fluid mechanics. The emperical methods in use, no doubt, yield qualitative results, but they are not completely dependable even after thorough experimentation, as expansive flow is not completely reproduced in models under the Froude criterion. The existing analysis so far has provided only a physical picture of the controlling factors whose quantitative assessment is still beyond the reach of the engineers. Among these factors, the author feels that the lateral velocity variation presents the most important characteristic of a transition.

The proposed transition formula $x = \frac{B}{y^{\frac{1}{2}}} + A$ evolves logically and scientifically with a systematic model experimentation and is self-evident under the assumptions made. The recommendation is not, however, made merely on the basis of tests described in this paper. A review of the literature and the valuable efforts of several other pioneers in the field, together with author's work on the design and critical examination under field conditions, have gone towards framing these conclusions. They bring out only a part of the solution, *viz.*, the optimum geometry of expansive sub-critical transitions. The proposed sub-critical expansive transition has the justification of rigorous mathematical derivation under the assumptions made and the support of extensive laboratory examination. In spite of the apparent simplification of a complex problem, the proposed formula would yield a more dependable and easier solution than available at the moment with the one-dimensional approach which involves doubtful approximations and arduous mathematical computations.

A New Method for the Analysis of Stability for Earth Dams

Dr. J. Purushotham
Associate Member

In the determination of the stability of an earth dam, many variable factors such as the density of soil, cohesion and angle of shearing resistance, pore pressure, and shear stresses between slices are involved. All these lead to laborious, repetitive and time consuming computations in arriving at the critical surface and the factor of safety for a given set of parameters. In this paper, the author deals with the investigations conducted by him in the U.K. on the stability of earth masses. As part of his research work, he had an opportunity of using a Mercury electronic digital computer for the solution of problems of stability of earth masses, specially in earth dams and retaining walls. The author has developed a new method for determining the stability of a dam with a puddle core and the location of the slip surface with or without an electronic digital computer. The historical background of the theory for determining the stability of earth dams and the technique developed by the author on the Mercury electronic digital computer (and also by the hand method) are dealt with.

Bearing Capacity of Single Pile by Static Penetration Test

M. Raghunandan
Student

In this paper, static penetration test results are correlated with pile test results and base factors are proposed for determining the bearing capacity of single piles in cohesionless soils. It is found that the bearing capacity does not vary much with the base area of a pile but varies with the cone resistance.

ROADS AND ROAD TRANSPORTATION GROUP

Traffic Accidents and Their Specific Problems in Assam—2

G. C. Sharma
Member

The first part of the paper described the general trends of growth in population, construction of road mileages, and motor vehicle industries and their manufacturing capacities in our country now and in the future; and gave a comparison of (i) accident rates and population, and (ii) road mileage and number of motor vehicles. It indicates in the second part of the paper the major elements in road traffic accidents and their causes and the recommendations for safety measures in respect of Assam. Finally, it outlines the problems for future studies and suggests remedial measures for prevention of traffic accidents.

MECHANICAL ENGINEERING DIVISION

Investigation of the Stiffness of a Horizontal Milling Machine Under Static Load

A. Chakravarty
Associate Member

Machine tool designers recognize the need for greater stiffness in machine tool structures. But there are many problems yet to be solved before stiffness can be predicted to close limits of accuracy without building the machine tool first. An account is given of an investigation conducted by the author to determine experimentally the deflections of the column of a horizontal milling machine under a static loading system and compare the results with those obtained from theoretical considerations, the column being assumed to be subject to identical loads. It was found that the experimentally obtained values of deflections were in each case higher than the calculated results, and the conclusion was drawn that, because of insufficient knowledge with regard to the behaviour of a loaded machine tool structure, the assumptions made for the calculations resulted in higher values of stiffness.

Accurate Determination of Drill Thrust and Drill Torque

S. C. Das
Non-member
and
S. K. Basu
Associate Member

In this paper, a generalized empirical relationship is established for accurate determination of the thrust and torque involved in a drilling operation. It analyses critically the nature and character of the various parameters such as tool geometry, condition of cutting, etc., which have considerable influence on the thrust and the torque under dynamic condition. No attempts have been made in the past to find out separately the

effect of varying point angles, lubricant, etc., on the thrust and the torque when drilling and machine tool designers had no other alternative but to be satisfied with the widely varied value of one overall constant for finding the thrust or the torque. The authors' experiments lead to a more accurate determination of the power consumption and strength of the machine members, and will, it is hoped, prove to be of benefit to machine tool designers.

Stability of a Simple Surge Tank with a Long Penstock

R. N. Ingle
Non-member
and
A. K. Chaudhuri
Non-member

The accepted Thoma's theory of stability for simple surge tank does not take into consideration the effect of penstock on downstream side of the surge tank, nor it accounts for the effect of a realistic governor. This paper develops and discusses the theory of stability for simple surge tank considering the effects of long penstock and realistic governor. A modified criteria for stability in terms of minimum area of surge tank is suggested.

ELECTRONICS AND TELECOMMUNICATION ENGINEERING DIVISION

Telegraph Codes for the Phonetic English Alphabet

S. Balaram Rao
Associate Member
and
S. Raghunatha Rao
Associate Member

Telegraph codes for the phonetic English alphabet are proposed in this paper. Three alternatives for the Morse code and two alternatives for the teleprinter code are indicated. The first two alternatives for the Morse code are respectively based on minimization of channel time and ease of operation. A combined consideration of both the foregoing factors leads to the third alternative, a factor designated 'durel' being defined for the Morse signal for each letter. The two teleprinter codes are based respectively on the 5-unit three-shift system and the 6-unit two-shift system. The relative merits of each of these two systems are briefly referred to and the relative speeds of transmission estimated.

Three-in-One Six-Porte Phase Detection-Regeneration Correction Circuit

R. P. Billimoria
Non-member

The technique of bias correction of D.C. telegraph signals using phase-sensitive rectification by a full wave push-pull detection circuit configuration, and generating in one two-porte output of the rectifier a reference regenerated D.C. modulated signals, and then reproducing by phase-synchronized correction in another two-porte output of the rectifier, is described in this paper. The technique is a novel one in that it includes regeneration and then correction of the D.C. signals in a phase sensitive rectifier all in one circuit, and the regeneration is also automatic and self-achieving or servo-occurring in the circuit itself, producing economic designs. The circuit is described.

A Novel Type of Compensation for Transistor Video Amplifier

Dr. A. K. Chatterjee
Member

J. G. Advani
Non-member

O. P. N. Calla
Non-member

and

P. K. Chatterjee
Non-member

A method is described in this paper to improve the bandwidth of transistor video amplifiers, using transistors of alloy junction type in common-emitter configuration. In addition to the type of compensation used by Bruun, an inductance L is put in series with the load resistance R_L. The two parameters C_e and L can be varied giving more flexibility for increasing the bandwidth. The theory and design data for the two parameters are dealt with in the paper Though the calculations for the design of two stages in cascade is more complicated, this work is being followed up for the design required for the compensation of a cascade amplifier.

Simulation of Third Order Systems with a Lead and a Time Constant Using One Operational Amplifier

L. K. Wadhwa
Non-member

and

H. S. Rao
Non-member

The paper outlines a method for the simulation of third order linear systems with only one operational amplifier. A particular class of the general third order systems, *i.e.*, systems with a lead and a time constant, is considered. Three basic circuits, each consisting of one operational amplifier, three capacitors and six resistors are presented. The circuits are analyzed and the conditions of physical realizability obtained. The design formulae and procedure are also given.

INSTITUTION NOTICES

Additional list of Referees for Students appearing in Section B of the Associate Membership Examination

The following is an additional list of referees to that which appeared in the *Bulletin* of October 1962.

Bengal Centre

100. AM 2893 S. S. Bhattacharjye (C)
District Engineer, Construction (Planning), Eastern Railway, 38 Chowringhee, Calcutta 16.

101. AM 4025 P. N. Bhattacharya (M)
Lecturer, Jadavpur University, Calcutta 32.

102. AM 7705 Dinabandhu Bhattacharyya (E)
186 Vivekananda Road, Calcutta 6.

103. M 1557 Dhirendra Nath Gupta (C)
1/6 Fakir Ghosh Lane, Calcutta 35.

104. AM 8185 J. Majumder (C)
15A Jubilee Park, Calcutta 33.

Bihar Centre

32. AM 3268 Prof. Sidheshwar Prasad (C)
Executive Engineer, Concreting, D.V.C. Panchet Project, P.O. Panchet Dam, Dist. Dhanbad.

33. AM 9159 Sheo Nandan Prashad (C)
Executive Engineer, P.W.D. Dhanbad Div. No. 1, Dhanbad.

Bombay Centre

62. M 1764 D. K. Subrahmanyam (M, E)
3/417 Bhandaji Cross Road, Matunga, Bombay 19.

Gujarat Centre

43. AM 10542 K. P. Patel (C)
Block D 8 Govt. Quarter, Gulbai Tekri, Ambavadi, Ahmedabad 6.

Kerala Centre

29. AM 4332 K. Bharathan (C)
Superintending Engineer, Irrigation North Circle, Kozhikode.

30. M 2652 M. T. George (M)
Professor of Mechanical Engineering, College of Engineering, Trivandrum.

31. AM 2841 P. K. Kuruvila (C)
Superintending Engineer, Building and Roads, Alwaye.

32. AM 2522 C. V. Mannadiar (E)
Executive Engineer, Central Stores Division, Kerala Electricity Board, Alwaye.

Mysore Centre

30. AM 7345 H. V. Ananthanarayana (E)
2097 Second Main Road, Malleswaram, Bangalore 3.

31. AM 6623 K. M. Gangadharaiah (C)
B. V. B. College of Engineering and Technology, Hubli.

32. AM 6545 H. S. Visweswaraiah (ET)
35 N. R. Colony, Basavangudi, Bangalore 4.

Orissa Centre

17. M 2564 B. Gopal Rao (M, E)
Chief Electrical Engineer, Rourkela Steel Project, Rourkela 1.

18. M 2479 Srinivasiengar Ramiengar (C)
Deputy Chief Engineer (Civil), C/9 Senior Officers' Bungalow, Sector 4, Rourkela 2.

Uttar Pradesh Centre

140. AM 3176 Krishan Chandra (C)
Dy. Chief Engineer (West), N. E. Rly., Gorakhpur.

NAMES OF SUCCESSFUL CANDIDATES IN THE STUDENTSHIP AND ASSOCIATE MEMBERSHIP EXAMINATIONS HELD IN NOVEMBER 1962

The following candidates have been declared to have passed the Studentship and Associate Membership Examinations held in November 1962.

STUDENTSHIP EXAMINATION

Roll No.	Name of candidate
St. 43	Narayanaswamy Jayaraman
St. 45	S. S. Radhakrishnan
St. 47	K. Swaminathan
St. 51	Thomas Emerald Samuel
St. 99	M. G. Krishna Iyengar
St. 110	Keshav Vasudev Khare
St. 126	P. N. Krishnan
St. 129	Vishnu Hirojee Satam
St. 146	S. S. Samarth
St. 149	M. H. Abdul Kadir Mujavar
St. 154	D. Ramasubramanian
St. 156	Mahadeo Bapu Shinde
St. 157	Dharam Vir Gupta
St. 160	Dilbagh Singh Deswal
St. 162	Narasinh Rama Hegde
St. 165	Dilipsen Vijaysen Tambane
St. 179	Narinder Kumar Bali
St. 199	Devi Prasad Maikhuri
St. 203	G. V Deshpande
St. 207	Swaminathan Thiagarajan
St. 216	Placido Luis Vaz
St. 266	Amalendu Mozumder
St. 268	Rasamoy Bhattacharya
St. 273	Gour Krishna Dey
St. 314	Mittar Gopal Khaneja
St. 324	Ram Singh
St. 340	Narinder Paul Handa
St. 342	Krishan Kumar Sharma
St. 350	Gulab DasBurman
St. 352	Vidyasagar Phool
St. 353	Sat Pal Sharma
St. 355	Om Prakash Sethi
St. 359	Gobind Singh Sharma
dt. 374	Ram Narain Rashmi
St. 375	Mahesh Chander Dhawan
St. 381	Parshotam Lal Sachdeva
St. 385	Jogindar Singh
St. 397	Ram Sarup Singh Saini
St. 419	Surender Kumar Butta
St. 432	Baldev Krishen Verma
St. 444	Adiveppa Venkappa Jadhav
St. 452	Mudunuri Bhadri Raju
St. 454	V. V. S. Suryanarayanamurty
St. 455	Sammeta Rama Subba Rao
St. 457	Kundam Seetha Rami Reddy
St. 464	M. S. Sundara Rajan
St. 479	Rattan Mani Sewal
St. 487	C. N. Gokhale
St. 503	Har Bhagwan Prabhakar
St. 524	Madan Lal Parnami
St. 540	Adhir Kumar Sen
St. 559	Ranbir Singh Yadav
St. 568	Ravi Nandan Agarwal
8t. 572	V. K. Kshirsagar
St. 581	D. Umamaheswara Rao
St. 587	Dharmalingam Singaravelu
St. 590	T. P. John
St. 596	V. V. Subramanian
St. 605	K. Venkatagiri
St. 611	Adinarayanan Somasundaram
St. 615	M. Muralikrishna Reddy
St. 628	Koduri Veerabhadra Rao
St. 629	Arumuga Udayar Jegadeesan
St. 633	V. Radhakrishnan
St. 634	Desu Upendrasai Prasad
St. 636	Krishnamurthy Gurunathan
St. 643	Veerasami Rajagopal
St. 644	Kanhangad Dayananda Pai
St. 646	Muthusamy Pothiraj
St. 652	M. K. Sriraman
St. 653	K. Viswanathan Nair
St. 660	Subramaniam Dhandapani
St. 666	Simhadri Balakrishna Rao
St. 677	Reddi Surya Gopala Rao
St. 678	G. S. Naidu
St. 703	N. Padmanabhan
St. 720	Gonupalli Bhoopaiah
St. 730	E. S. Neelakantan
St. 733	Sampangirah Subramanian
St. 754	G. R. Reddy

Roll No.	Name of candidate	Roll No.	Name of candidate
St. 756	Ratakonda Venugopal	St. 872	M. S. Mohite
St. 757	K. C. Ramachandran	St. 880	D. L. Mahajan
Ft. 823	Joginder Singh	St. 898	Jawahar Lal Raina
St. 834	Jagdev Singh Kainth	St. 910	Lukose Philipose
St. 861	Bhagwat Mandal	St. 925	G. R. Nair

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A

(Existing Scheme)

Roll No	Name of candidate	Roll No.	Name of candidate
12A	Rishi Bhushan Gupta	394A	N. C. Rao
15A	Laghhman Gagumal Vanjan	395A	M. V. Venkateshananda Kumar
37A	A. M. Desai	396A	M. A. Jabbar
42A	Bhupendra Seventilal Shah	424A	Sethurao Narasimha Murthy
79A	Ambalal Desaibhai Patel	451A	M. C. Venkatesh
107A	Ravi Kondaiah	454A	N. S. Sreenivasa Rao
115A	Meloth Kumaran Nambyar	457A	Koratookere Narayana
117A	Kishore Krishna Rao	489A	V. Sadanandan
126A	Anant Keshav Havanurkar	495A	K. Mani
140A	Nampurath Krishnan Kutty	527A	Manne Rama Rao
156A	B. S. Visweswara	544A	M. S. Vasudevan
157A	Syed Abdul Wajid Pasha	593A	G. L. Bhargava
158A	G. S. Lakshminarayana	600A	Krishandas Gattulal Shah
167A	Sirur Suresh Rao	602A	A. H. Abdur Razzaqe Shaikh
178A	B. K. Sathyanarayana	624A	Ganga Singh
188A	H. S. Ramachandra	662A	Manmohan Singh Bhangoo
194A	T. Ramachandran Srinivasan	728A	C S. Ramachandra Murthy
195A	Coca Raiprasad	760A	Kishin Motumal Motiramani
198A	K. S. Satya Moorthy	762A	Premnath Shetty
204A	Srikantaiah Nagendran	768A	N. T. Makhijani
205A	D. N. Lakshminarasimhiah	776A	Achilles Anthony D'Souza
236A	B. A. S. Rao Keshava Murthy	783A	H. M. Joshi
238A	A. V. Rajagopala Adiga	799A	P. V. Paranjpe
242A	L. Lakshminarayan	816A	Anant Gopal Tilak
258A	Hosallappa Shivarudraiah	818A	S. C. Bhattacharyya
272A	T. Dyamanna	855A	Jaswant Kumar Banerjee
286A	Vasudeva Murthy	877A	A. F. Vasanwala
289A	Krishan Lal	892A	P. S. Patel
291A	Kodihalli Thammaiah	925A	Madhav Narhar Kelkar
303A	Rajendra Kumar Agrawal	927A	M. V. Radhakrishnan
305A	Alaham Srinivasan	937A	Gouranga Sinha
310A	K. N. Srivatsa Iyengar	957A	Damodar Keshav Bene
342A	P. S. Raghavendra	960A	Parimal Kumar Sanya
364A	Venkatarao Ranga Rao	969A	M. K. Desai
383A	K. A. Natarajan	987A	C. K. Hariharan
390A	Suraparaju Doraswami	993A	Y. N. S. Rao
392A	Grama Kasturirangan Raman	1000A	Mrs. M. N. Bhujbal

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A (*contd.*)

Roll No.	Name of candidate
1034A	R. Lakshminarayana Ayyar
1244A	Akhil Bandhu Mukherjee
1247A	Satyabrata Biswas
1264A	Dilip Kumar Sinha
1312A	Siladitya Ghosh
1323A	Chitta Ranjan Paul
1330A	Milan Kumar Roy
1333A	Rabindranath Basu
1334A	Sibadas Pramanik
1451A	Sukumar Biswas
1482A	Dinalesh Saha
1491A	Shyamal Kumar Sengupta
1492A	Nani Gopal Mitra
1518A	Sukumar Mitra
1529A	Panchugopal Chakrabortty
1532A	Dinabandhu Biswas
1545A	Kusal Kumar Nandi
1547A	Arun Kumar Basu
1567A	Dipak Kumar Ghosh
1578A	Samar Nath Goswami
1596A	Nityananda Biswas
1634A	Dilip Kumar Chowdhury
1635A	S. Bandyopadhyay
1636A	Subodh Krishna Pandit
1643A	Hara Dhan Pollya
1649A	Nikhilpati Bose
1650A	Prajesh Kumar Chakraborty
1654A	Sumiti Kumar Sinha
1662A	Birendra Nath Basu
1673A	Nitya Ranjan Pal
1674A	Kali Das Mukherjee
1675A	Ranjit Datta
1707A	Prabodh Ranjan Sen Sarma
1709A	Debes Kumar Bhattacharyya
1711A	Arun Kumar Datta
1720A	K. G. Kutty Menon
1724A	Salil Kumar Gupta
1732A	Shyamal Kanti Ghosh
1775A	Samar Kumar Bhattacharya
1777A	Soumendra Chakraborty
1790A	Phatick Chandra Datta
1799A	Susanta Kumar Sinha
1876A	Dilip Kumar Roy Chowdhury
1883A	T. Narayanan
1887A	S. C. Bhattacharyya
1900A	Saroj Kumar Gangopadhyay

Roll No.	Name candidate
1911A	Harsha Kumar Mukherjee
1935A	Arun Kumar Paul
1986A	Nirmal Kumar Sinha
2029A	Chandra Prakash Taparia
2067A	Phanindra Nath Mandal
2068A	Nikhil Ranjan Sen Gupta
2082A	Kulendu Das Gupta
2087A	Subha Bindu Das Gupta
2105A	Sanjoy Kumar Das
2111A	Sanat Kumar Rishi
2153A	Anil Bhushan Mukherjee
2209A	B. C. Mukhopadhyay
2251A	A. C. Kulkarni
2267A	Ramakanta Pattnaik
2277A	Saheb Prusty
2287A	Kailash Chandra Panda
2288A	Bhagabati Prasad Patnaik
2328A	Nakul Chandra Sahoo
2344A	Bibhuti Bhusan Rout
2357A	M. K. Ramaraju
2359A	Prahalad Palo
2383A	Kanwal Nain Goya
2387A	Harbans Singh
2395A	Sardar Singh Mehta
2396A	Inder Jit Gandhi
2402A	Yogeshwar Dayal Tawakley
2447A	Shiam Lal
2449A	H. Natarajan
2490A	Bhupinder Bir Singh
2492A	Chandra Sen
2499A	Janak Raj Arora
2503A	Dilbagh Singh
2510A	Manindra Bhusan Roy
2515A	Sant Prashad Gupta
2522A	Mohd. Shafiq Siddiqi
2526A	Ved Prakash
2532A	Chander Parkash
2536A	Virendra Singh Garg
2540A	Krishna Kumar
2551A	G. C. Pande
2555A	Baldev Singh Harish
2576A	Jagdish Rai Bhasker
2591A	Om Parkash
2616A	Sheo Nath Singh
2626A	Daljit Singh Gill
2649A	Amar Nathani

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A (*contd.*)

Roll No.	Name of candidate
2652A	Prem Narayan Sharma
2665A	Darshan Singh Bhatia
2668A	Bhola Nath Nayak
2679A	Rajendra Prasad Varshney
2684A	Chander Swaroop Agarwal
2686A	Nem Chandra Jain
2688A	Prem Prakash Dhingra
2694A	Pritam Singh Ahuja
2703A	Prem Nath
2708A	Thottayil Devassy Jose
2713A	Cpl. Amithabha Biswas
2719A	Shiv Shankar Bansal
2721A	Purshottam Kumar Gupta
2723A	Raj Kumar Chandna
2768A	Swedesh Kumar Kapur
2771A	Balraj Lamba
2789A	Brij Mohan Lal
2792A	Amarjit Lal Chawla
2808A	Ram Saran
2813A	Ranjit Rai Bhaskar
2820A	D. D. K. Chandiramani
2825A	Kuldip Singh Bhalla
2830A	Gulshan Rai Jain
2842A	Satgur Dass
2866A	Vijay Kumar Puri
2877A	Tej Pal Singh Verma
2882A	Prithvi Raj Malhotra
2892A	Suraj Prakash Ahuja
2927A	Balraj Kumar Trehan
2946A	Satya Paul Duggal
2952A	Jai Krishan Nagpaul
2953A	Satya Pal Anand
2964A	Gurcharan Singh
2967A	Amrik Singh
2974A	Jyoti Prakash S. Mathur
2976A	Surinder Kumar Khosla
2987A	Vishindass K. Khushalani
2995A	Narendra Kumar
3003A	Kharaiti Lal
3015A	Rajinder Dutt Sharma
3054A	Prem Nath Garg
3073A	Bakhshish Singh
3079A	Mahinder Pal Singh
3081A	M. N. Ahuja
3123A	Lal Chand Mittal
3130A	Om Parkash Bhatia
3199A	Shyam Lal Chatterjee
3213A	Girish Chandra Garg
3223A	Suresh Bahadur Mathur
3230A	Raj Kishore Srivastava
3248A	Jagat Kumar
3250A	Mahaveer Prasad Mittal
3252A	M. S. Srivastava
3281A	Kishan Chand
3298A	Hari Krishan
3331A	Surendra Singh Negi
3359A	Shiv Lal
3390A	Ramesh C. Chatwani
3394A	Brij Bhushan
3397A	Suhail Ahmad Usmani
3399A	Narendra Kumar Gupta
3472A	Dal Chand Gupta
3477A	Raj Vir Singh
3505A	Baldev Raj Chanana
3577A	Man Mohan Singh
3589A	Yog Dhian Adlakha
3610A	Aurobindo Chakravartty
3611A	Hirendra Chandra Das
3613A	Jagadish Chander Wason
3614A	Harnam Dass Arora
3618A	Sibendra Kumar Choudhury
3634A	K. C. Sarma Bardoloi
3635A	V. Subramanian
3646A	Achintya Kumar Sikdar
3664A	Manohar Lal Taneja
3679A	Kumar Awadhesh Prasad
3681A	Dashrath Prasad
3693A	Quamrul Wassey
3696A	N. V. Rama Sastry
3697A	Gulab Singh Arora
3699A	Gamalla Ramakrishna
3708A	C. Atchyutarama Rao
3727A	Mushtaq Hussain
3733A	R. Hanumantha Rao
3740A	P. Nanibhushana Rao
3743A	D. G. Krishna Rao
3750A	Vishwanath Yerrawar
3776A	Vasa John Koteling
3787A	Makkapati Gurucharanam
3808A	Vajrala Krishnaiah
3815A	K. Pamalingeswara Rao
3828A	Mohammed Moinuddin

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A (*contd.*)

Roll No.	Name of candidate
3834A	B. S. Sastry
3852A	Chitta Subrahmanyam
3904A	P. V. R. Murthy Sarma
3951A	Adabala Rama Mohana Rao
3963A	Geddam John Sudhakar
3973A	Ganta Simhachalam Naidu
3979A	Ali Raza
4020A	Bhogaraju Satyanarayana
4048A	Priya Gopal Paul
4075A	Gurmit Singh Grewal
4104A	Rajdeo Singh
4110A	Chhote Lal Garg
4124A	Pushpinder Pal Goswamy
4159A	Kamal Parkash Sahni
4214A	Ram Sahai Sharma
4223A	Basant Kumar Goswami
4228A	Suryakant Waman Kulkarni
4247A	Ved Raj Thukral
4267A	Anand Prakash Trivedi
4302A	D. A. Pardasani
4305A	Tilak Raj Banga
4335A	Mahesh Chandra Gupta
4336A	Jiwat Bhagchandani
4343A	Ram Kumar Gupta
4354A	Bhanwar Lal Jain
4360A	Shambhu Bhambhani
4373A	Kul Bhushan Lal Dhodhi
4400A	Chandra Pal Dikshit
4487A	Ganti Veerabhadram
4512A	Sadhu Singh Saggu
4517A	Ragam Sambasiva Rao
4540A	Subramania Srinivasan
4549A	Tarakanta Panda
4575A	Krishna Chandra Jha
4582A	Nalini Kanta Misra
4599A	Pratty Subba Rao
4605A	Arun Kumar Ghosh
4630A	Avinashi Chandra Nagar
4643A	Mohammad Kalim
4655A	Jagdish Kishore Misra
4664A	Tulsi Das Ahuja
4677A	Bajrangi Rai
4690A	Krishna Autar Gupta
4695A	Sharwan Kumar
4700A	Hari Om Prasad Srivastava
4708A	Gurjit Singh Birdi
4712A	Girraj Kishore Agrawal
4714A	Santosh Kumar Goel
4722A	K. A. Chachra
4745A	Lovraj Singh Karaulia
4750A	Bir Bhanu Singh Bhadauria
4751A	Ram Mohan Sharma
4755A	Swayam Prakash
4783A	Shiv Kumar Misra
4804A	Subodh Behari
4812A	Harkishen Lal Julka
4820A	Ram Chandra Srivastava
4844A	Ram Krishna Awasthi
4857A	Hari Mohan Singh
4858A	Hakim Singh
4886A	Chandra Prakash Arora
4896A	Shreepati Singh Yadav
4900A	Sharda Prasad Misra
4903A	Rameshwar Prasad Rastogi
4924A	Ghanshyam Mishra
4928A	Ram Chandra Pandey
4969A	Hari Mittar Bhalla
4981A	Anand Mohan Singh
5014A	Satish Kumar Sharma
5018A	Jagdish Prasad Garg
5045A	Iqbal Hussain
5048A	Brahma Nand
5063A	Debadas Maitra
5091A	Bijoya Kumar Mohapatra
5094A	Abdul Gafoor Abdul Aziz
5095A	Kovoor Mathew Mathew
5098A	M. Chandrahasan
5106A	Chatlapalle Ramana Rao
5112A	Mohamed Ismail Sait
5121A	E. Natarajan Krishnamurthy
5123R	T. S. Subbarathinam
5149A	Srinivasan Raghunathan
5152A	K. P. Subramanian
5155A	M. Damodharan
5156A	Ranganatha Venkataraman
5161A	Janakiram Sundarraman
5164A	Madhusudhan Reddy
5165A	Budhi Jayaram
5170A	Kamma Venkateswara Rao
5175A	P. S. Kumaraswamy
5177A	M. Gopalakrishnan
5178A	C. Lakshmikanthaiah

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A (*contd.*)

Roll No.	Name of candidate
5181A	Ramasamychetti Rajasekar
5185A	Godavarty Kondayya
5202A	K. Venkatachalayya
5206A	Ramchandraiyer Jayaraman
5207A	Miss K. S. Saroja
5211A	S. Neervanan
5214A	Dasari Madhava Rao
5215A	Chitturi Subba Rao
5225A	D. Aswarthanarayana Reddy
5233A	Vaiyapuri Kandaswami
5238A	Niranjan Kumar Dash
5239A	Surendra Kumar Mahapatra
5244A	Jagadesan Nithyanand Iyer
5245A	H. S. Reddy
5246A	T. V. Sundara Siva Rao
5255A	K. C. N. Nambudiri
5261A	Gourang Charan Behera
5263A	Natarajan Ramamurthy
5271A	Krishnaiyer Sankara Iyer
5279A	Venkataramana Vasudeva
5281A	K. Lakshmikanthan
5286A	Ramesh Chandra Nayak
5289A	Sricharan Acharya
5290A	Braja Mohan Mohanty
5293A	Vemu Suryanarayana Murty
5294A	Subramony Venkitaramanan
5299A	K. Makarabushanam
5307A	Rabindra Kumar Sarangi
5312A	Saranathan Ramadurai
5314A	K. Venkateswara Rao
5324A	Subramanian Ramamurthy
5328A	K. S. Krishnasamy
5335A	M. Peddaiah
5358A	M. V. Joga Rao
5394A	Challagulla Nageswara Rao
5395A	Srinivasa Krishnaswamy
5398A	C. K. Subramaniam
5445A	Rangaswami Jagannathan
5458A	P. V. Sita Ramanjaneyulu
5478A	R. R. Rajagopalan
5482A	Senapati Jagannath Rao
5483A	R. V. Ramachandra Rao
5486A	Ramaswamy Desikan
5489A	Bedathala Akki Reddy
5503A	Eruvu Saileswar
5534A	S. N. Nagarajan
5551A	Chintamani Jagannath
5554A	M. Y. Prasada Rao
5555A	C. A. V. Raman
5558A	S. Srinivasaraghavan
5561A	U. S. Accharya
5562A	Srinivasa Subramanian
5567A	A. Samuel D. Money
5580A	T. Rajagopalan
5583A	H. S. Durga Prasad
5606A	N. Venkatesan
5615A	N. M. Tragar
5629A	R. Naraynan
5639A	Vadapalli Suryanarayana
5662A	Sivasangu Jeyachandran
5676A	C. Kumaran Dasan
5716A	Kotra Mahadeva Sarma
5744A	Ramachandran Padmanabhan
5755A	E. V. Sanyasi Kamaraju
5764A	A. C. Rajappa
5800A	Krishnamaraja Ramachandran
5818A	Kanniappan Jayaraman
5820A	G. Janaki Ramiah Chetty
5826A	S. Munisamy Loganathan
5849A	Rajagopala Narayanan
5851A	H. G. Krishnan
5858A	Ramabadra Devanathan
5905A	Balasundaram Srinivasan
5908A	Jaleswar Dhar
5911A	Aykkara Unnikrishnan
5915A	B. K. Balaram
5916A	Priti Pal Singh Sawhney
5925A	H. Singh
5931A	Navanit Virchand Lotia
5983A	Gopal Sakharam Akre
5984A	S. S. Deshmukh
6031A	Hari Chand Mehta
6037A	Subhas Chander
6041A	Baljit Singh Nayar
6045A	Romesh Chandra Bhardwaj
6054A	Ajit Kumar Goswami
6072A	Parkash Singh
6079A	Satya Narayan Gupta
6094A*	Amar Jit Aggarwal
6096B	Shiv Kumar Kalra
6098A	Harbans Lal
6106A	Tara Singh Thind

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION A (*contd.*)

Roll No.	Name of candidate	Roll No.	Name of candidate
6115A	Dharam Vir Gupta	6693A	Vasant Ganesh Achawal
6123A	Darshan Singh	6700A	S. Anant Kamalapurkar
6124A	Abnash Singh	6702A	A. V. Narasimham
6130A	K. N. Thiruneelakantan	6725A	Gururaj Keshavrao Chebbi
6132A	Satindar Mohan Kharabanda	6733A	Anil Vasudeo Agashe
6133A	Pratap Ji	6735A	Kishor Damodar Gujar
6136A	Prem Nath Goyal	6736A	Robert John Fernandez
6140A	Jatinderjit Singh Sidhu	6739A	Bhisham Lal Gogia
6161A	Jagjit Singh	6772A	Gurnam Singh Gupta
6170A	Pritam Singh Binner	6780A	H. Dattatraya Rao
6174A	Harish Pratap	6791A	S. R. Ghorpade
6179A	Amarjit Singh	6826A	Damodar Anant Gadre
6188A	Gurcharan Singh	6877A	Manohar Naryanrao Purohit
6197A	Megh Raj Bansal	6914A	B. P. Shrivastava
6208A	Kashmir Singh	6915A	Arivind Bhagwant Patil
6242A	Sharan Kumar Gupta	6921A	Heramb Moreshwar Pathak
6244A	Gurmukh Singh	6954A	D. B. Ghatpande
6254A	Sohanjit Singh Athwal	6963A	Padiyath Aravindakshan
6291A	Gurdip Singh Gujral	6968A	N. S. Yakkundi
6299A	Nek Ram Kashyap	6998A	T. V. Vasudeva Murthy
6345A	Harbans Lal Handa	7015A	Sasanka Sekhar Ray
6451A	Ramji Lal Shrivastav	7019A	Samarendra Basak
6453A	Babua Jha	7031A	M. D. Advani
6464A	Padmanabhan Venkataraman	7061A	S. D. Kulkarni
6466A	Arvind Kumar	7070A	K. V. Janardana Bhat
6467A	Gurcharn Singh	7076A	Vittal Ramkrishna Bhat
6473A	Dineshwar Prasad Singh	7081A	Rajinder Singh Bhatia
6482A	Jagdish Lall	7088A	Moti Lal Dhar
6492A	Baidya Nath Kumar	7089A	Omji Lall Raina
6500A	Tipan Prasad	7102A	Piaray Lal Jalali
6526A	Bhagwat Pershad	7113A	S. R. Menon
6532A	Ramesh Chandra Sinha	7123A	K. Narayanan Kunji
6534A	Deo Sharan Singh	7124A	M. Neelakanda Balagopalan
6562A	Kanak Kishore Prasad	7149A	P. V. Chacko
6569A	Surya Narayan Sinha	7154A	V. K. Ummer
6581A	Ram Bihari Choudhary	7156A	T. R. Narayanan
6588A	Kuber Nath Pandey	7158A	V. K. Gopinathan Nair
6609A	A. D. Prasad Singh	7195A	P. T. Thomas
6633A	Pramod Kumar Arya	7201A	S. V. Potti
6686A	Yashawant Ganesh Brahme	7212A	Sivaraman Bhoothalingam
6687A	A. P. Inamdar	7221A	Bhaskar Ranganatha Rao

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION B

(Existing Scheme)

Roll No.	Name of candidate	Roll No.	Name of candidate
1B	N. R. Shah	2B	K. K. Goplani

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION B (*contd.*)

Roll No.	Name of candidate
12B	Avtar Krishan Nanda
24B	Krishnappa Srinivasarao
29B	Jagdish Mohan Karir
32B	Badrinarayan Randad
33B	K. N. Gundu Rao
48B	S. R. Nagaraja
50B	Shamanna Subbarao Kurpad
60B	K. V. Subbaram
62B	Y. R. Nagaraja
68B	Kallur Ramarao Sreedhara
73B	C. S. Ramachandran
77B	N. S. Narasimhaswamy
83B	Pronay Tosh Sen
86B	Pushkar Nath Lahru
87B	Kishore Lal Sharma
88B	M. N. L. Kanthu
93B	S. Arkeswaraiah Sivaram
97B	K. Prabhakara
98B	Rama Krishnaiah Nagaraja
106B	Sripathyrao Lakshmana Rao
110B	R. K. Subramanian
115B	M. C. Sampathu
117B	A. V. G. Rao
125B	Kaleekkal Koshy Varghese
126B	U. M. Sastry
139B	G. K. Venkata Rao
140B	Jamiat Singh Pawar
147B	Chandrakant Bhikaji Takle
148B	V. D. Dandekar
149B	S. Sankaranarayanan
155B	Inder Jit Rally
160C	Puran Chandra Pande
164B	Mahesh Chandra
166B	V. S. Shellikeri
168B	Karsi Sharvaksha Bhagalia
172B	Biswanath Mukherjee
176B	Sadanand Vithalrao Kambre
177B	Moti Jawaharmal Gulrajani
179B	Thangaraj Seetharaman
180B	H. T. Punani
184B	Bhagavatula Parthasarathi
189B	Bhupal Hanumant Harari
192B	Sadanand Keshav Desai
193B	Dattatrya Keshav Joshi
194B	Jaydev Krishnaram Divecha
204B	M. R. Pungavkar
215B	L. V. Gundappa
217B	Suresh Narayan Patankar
218B	P. V. Ramakrishnan
219B	Achyut Ramchandra Railkar
228B	Johny Hormis Puthenangady
238B	Shashikant Waman Joshi
240B	M. A. Rangarajan
243B	N. P. Mandlekar
245B	Jayaram Rajaram Torney
246B	Sudhakar Gajanan Joshi
250B	Kinya Bhaskar Kamath
260B	S. R. Khandekar
261B	A. K. Ishwarlal Gandhi
266B	G. D. Joshi
284B	Chandra Nath Basu
292B	Atul Prasanna Ghosh
293B	Bhabatosh Som
295B	Bhobani Coomar Coondo
301B	Debabrata Sen
305B	Harish Chander Kaley
306B	Nanigopal Paul
310B	Shridhar Pathak
321B	Paritosh Maitra
325B	Manash Kumar Dutta
336B	T. N. Krishnamurthy
337B	Tirtha Ranjan Burmon
345B	Deb Kumar Bhattacharjee
355B	Asim Kumar Sarkar
363B	Shyamal Kumar Ghosh
367B	Arun Kumar Biswas
368B	Gobardhan Ray
370B	Sukumar Chakrabarty
371B	Ajit Kumar Mitra
376B	Jotish Chandra Nandi
377B	Ajoy Kanta Goswami
378B	Sukhendu Bikas Datta
380B	Suranjan Chanda
400B	Nikhilendu Pramanik
406B	Krishan Chandra
408B	Hirendra Nath Chakravorty
411B	S. K. Ghosh Chaudhuri
413B	Govind Sahai Mathur
415B	Tapan Kumar Banerjee
427B	Manik Chandra Ganguly
444B	Benoy Chandra Chakravorty
448B	Manoranjan Das

ASSOCIATE MEMBERSHIP EXAMINATION—SECTION B (*contd.*)

Roll No.	Name of candidate
456B	Deb Krishna Biswas
463B	Surendar Singh
469B	Ayyaswami Rajan
471B	Ranjit Kumar Majumdar
481B	Umamaheshewar Patnaik
490B	Hakim Singh Mahandwan
491B	Surya Narayana Behara
495B	Damodar Barik
498A	Jogeshwar Biswal
500B	P. C. Misra
501B	Bijoy Kumar Mohanty
506B	R. V. V. Satyanarayana
509B	Dhruba Charan Das
516B	Jogendra Nath Maharana
518B	Mahendra Nath Mohanty
519B	Sarat Chandra Chaudhary
523B	H. K. Biswal
526B	Brundabano Chandro Panda
529B	Inderjit Singh
533B	Ishwar Chandra Agrawal
535B	Sushil Kumar
544B	Narendra Kumar Kansal
546B	Gopal Chandra
547B	Mahesh Swaroop Gupta
555B	Cpl. Bakhshish Singh
563B	Ved Mitra Aggarwal
565B	Sushil Kumar
573B	Shyam Sunder Bhardwaj
576B	Ramesh Chander
591B	Jagdish Chandar
595B	Ashok Kumar Teckchandani
609B	Jagdish Prasad Mittal
614B	Din Dayal Chandra Agarwal
616B	Madan Mohan Lal Gulati
617B	Ac Balwant Singh
618B	Bhagwant Singh
619B	Dharm Vir Jolly
627B	Ramesh Chandra Minocha
628B	C. S. Teckhandani
629B	Raj Kumar Mehta
632B	Sadhu Ram Jindal
635B	Sahib Ram
638B	Sham Kumar Sangar
639B	Murari Lal
641B	Chunni Lal Bhatia
643B	N. L. Gandhi
650B	Vikram Singh
651B	Anand Sarup Rohilla
662B	Amar Nath Sehgal
664B	Bal Krishan Jinsi
668B	Khairati Lal Handa
678B	Bhajan Singh
680B	T. S. Teckchandani
692B	Jagdish Chander Dureja
695B	Jagdish Prasad Kaushish
697B	Rajindar Nath Kumar
700B	Sudarshan Kumar Wadhwa
704B	Parmanand Nenumal Ajbani
722B	Subodh Chander Chojar
728B	Thomas Noronha
732B	Narain Dass Kalra
734B	Charanjit Singh Chhatwal
740B	Surinder Kumar Handa
749B	Ilam Singh Verma
758B	Ramesh Narhar Jaywant
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THE BULLETIN

OF

The Institution of Engineers (India)

SECRETARY & EDITOR: B. SESHADRI, B.Sc., A.I.I.Sc., D.I.C., M.Sc.(Eng.), M.I.E.

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Contemporary World Engineering Project Series—24

Members are invited to contribute to this Series of special articles featuring major engineering projects which they may have visited or with which they may have been associated in any other manner. Articles should be preferably accompanied by photographs and illustrative sketches.

THE MENJIL DAM*

Introduction

The Sefid-Roud is one of the largest rivers in Iran. It has a catchment area at Menjil of 55,000 km.^{2}, and at this site the average yearly flow is 4,000 million m.^{3} of water, *i.e.*, an average flow of 120 m.^{3} per sec. Before the Menjil Dam was built, it fed 90,000 hectares of arable land in the Guilan plain in its lower course, the major part of which plain is comprised of rice fields. Before the completion of the project, 2,300 million m.^{3} of river water were wasted downsteam of Menjil. The purpose of the Menjil Dam is to use the major part of this water by retaining it in the dam reserves, and using the head of the water created by these reserves to produce electric power from the 4,000 million m.^{3} of water undergoing the drop.

The capacity of the reservoir created by the Menjil Dam is 1,800 million m^3. The difference in level between the upstream normal pool elevation and the downstream level at the foot of the dam is 80 m. The installed electric power will be, in the initial stage, 35,000 kW, and in the second stage 87,500 kW.

When the dam is commissioned, the irrigation water demand and the electric power demand will only require storage of 1,000 million m.^{3} of water yearly in the reservoir. As the new irrigation networks of the lower Sefid-Roud catchment basin and the Foumen plain develop, which will bring the irrigated area up to 220,000 hectares and as an interconnecting network is built between the various electricity works of northern Iran, to which the power plant of the dam will then supply 300 million kWh yearly, the storage capacity of the dam will be used to a greater and greater extent.

Site

The choice of the site for the Menjil Dam was influenced by considerations of a geological and topographical nature. The inlet to the Sefid-Roud gorge, which commences at Menjil and ends 50 km. downstream at Immam Zadeh Hachem is characterized by the presence of an important section of bedrock orientated in an east-west direction athwart the valley, 200 m. thick. This section of bedrock is comprised of layers of andesitic volcanic lava. Their strata angle is raised towards the upstream direction and forms a favourable foundation for a dam. Upstream of this rocky outcrop, the valleys of the two rivers which make up the Sefid-Roud, the Chah-Roud and the Kizil Ouzen spread out widely in two opposite directions, thus forming a wide bowl, where a lake with a surface area of 56 km.^{2} can be created at the normal pool elevation level of the dam, the arable land which will be submerged being very small and of lesser value compared to that which it will be possible to irrigate downstream. The relative width of the Sefid-Roud gorge at the right of the dam, the size of the river spates and the high quality of the bearing ground have governed the choice of a concrete construction, buttress-type dam.

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* Compiled from literature made available by courtesy of the French Trade Commissioner, Calcutta.

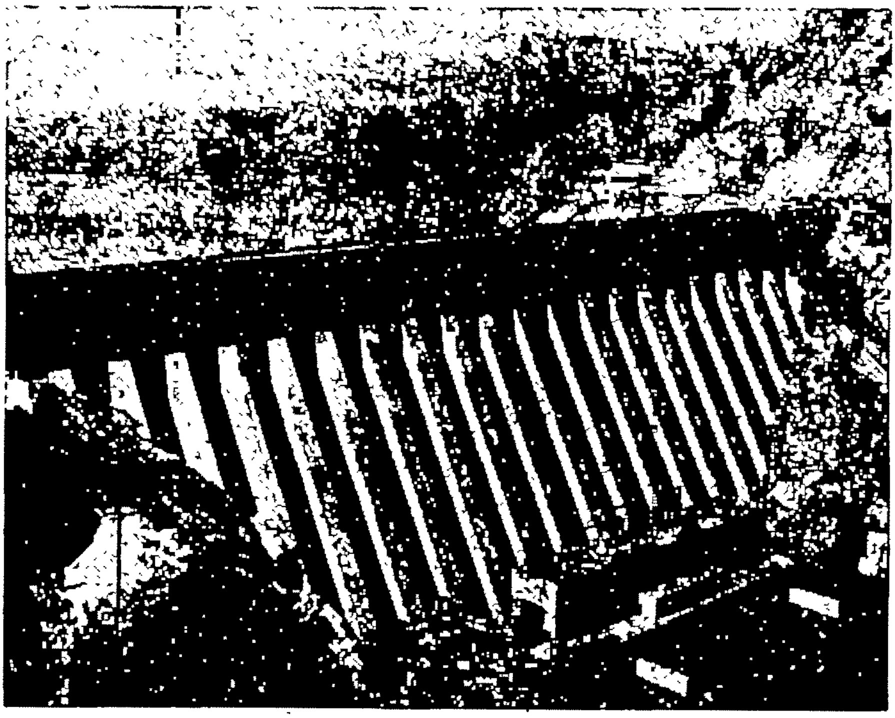

Fig. 1

The Manjil Dam on the Sefid-Road in Iran

The dam

The Sefid-Roud Dam is the highest buttress-type dam to be built until now in the entire world, and is among the 20 largest of all types as regards the water volume retained. 700,000 m.^{3} of concrete has been used in the construction of the dam, for the 30 buttresses, each 14 m. wide, the crest length being 425 m. The largest of the buttresses is 106 m. high. Each buttress, connected to the neighbouring buttresses by suitable sealing devices is self-supporting. The downstream face of every alternate buttress rest against a 'live stop' device which exerts a permanent thrust on the said face in an upstream direction, which reaches 28,000 tons. These 'live stops' employ a prestressing process invented by Freyssinet, making use of sack type jacks weighing 2,000 tons, secured by cement after being subjected to pressure. The upstream section of each buttress forms a face which is in continuous contact with the reservoir water. Sealing of the foundation soil on the right upstream face of the dam is ensured beneath the dam by a sealing curtain 100 m. thick, having a total surface area of 60,000 m.^{2} built using 17,000 m. of piling, calling for 6,500 tons of cement. Subjected to the pressure of the upstream water, the construction is, like all dams, also subjected to alternating distortions as the reservoir fills and empties. These distortions are measured so as to ensure that they fall within the prescribed limits, and these measurements are carried out using 5 pendulum and counter-pendulum units, 35 acoustical clinometers, 320 sonic probes and 70 thermoprobes. Arrival forecasts of the floods in the reservoir during the filling are made from two water level measuring stations, one sited at Ustul near Mianeh on the Kizil Ouzem, the other at Paroudbar on the Chah-Roud, and the results of these measurements are transmitted by radio and recorded at a receiver station situated at the dam.

Construction methods

The Sefid-Roud Dam was built in four stages :

1. Preliminary work stage ; exploratory borings, road detours, construction of dwellings and start-up installations ;
2. A work stage for changing the course of the river during the time the main installations were erected ;
3. A building stage for the dam and its spillway facilities and the engineering work of the power plant ; and
4. A phase for the engineering and electrical equipment of the dam, the flood spillways and the power plant.

1. *Preliminary work*

The total depth of the exploratory borings carried out was 6,900 m., and that of the roads 34 km. Two dwelling areas have been built to house the personnel.

2. *Changing the course of the river and building the principal installations*

The site of the dam was isolated so as to lay the foundation soil dry by deviating the Sefid-Roud into two 8 m. diameter round-section deviation tunnels, with a total length of 1,222 m. in the left bank of the river. In order to direct the flow of the river into these two galleries and to avoid the water returning into the foundation pits, two cofferdams built on Soletanche sealing pilings and constructed in crib brickwork protected by a barrier of Larssen sheet pilings were built, one upstream, the other downstream. The maximum flow which could be deviated *via* the galleries without flooding the cofferdams was only 1,200 m.^{3} per sec. However, these works were nonetheless designed to withstand flooding.

The principal installations of the dam built during the execution of the river deviations were :

(i) *The general service installations:* Offices, engineering and boiler making workshops, building appliance workshops, filling station and garage, general store and car park, a 3,400 kW electric power production thermal power plant, an 800 h.p. compressed air generating plant, the distribution network for the electric power (6,300 volts), for the compressed air, the water and the telephone network.

(ii) *The concrete-producing installations:* (a) A quarry working, equipped with compressors of 500 h.p., supplying a 38 in. primary crusher capable of a 400 ton per hr. throughput; (b) a belt-conveyor system with a throughput of 250 tons per hr.; (c) a secondary crushing station, a tertiary crushing station and a stockpile of classified aggregates capable of a throughput of 200 tons per hr.; (d) a supplementary river sand station, linked to a single wire overhead cable system crossing the upstream valley, producing 15 tons per hr. of washed sand; (e) an automatic station for the distribution and manufacture of concrete, with a throughput of 90 m.^{3} per hr.; (f) a group of four storage silos for stocking bulk cement (storage capacity 2,800 tons) and one station for the pneumatic transport of cement (throughput 20 tons per hr.); and (g) a set of three radial overhead cable ways, 11 tons each, the carrying cables each being 610 m. in length.

3. *Building the dam, flood spillways and civil engineering work of the hydroelectric power plant*

In the excavation pits, the laying down of the concrete work of the dam, the civil engineering work of the hydroelectric power plant was carried out from the right bank to the left bank while at the same time on the left bank the two tulip-form surface spillways were built, each being connected to the two existing deviation galleries.

The excavation pits of the dam and the hydroelectric power plant called for 250,000 m.^{3} of alluvial fill and 220,000 m.^{3} of rock to be removed. The rate of daily advance of the concrete work of the dam was, during the height of the building period, 1,100 m.^{3} of concrete per day, calling daily for the positioning of 350 m.^{2} of shuttering. The labour force was organized in two 10 hr. shifts, all external work having to be suspended for seven months of the year between 15.00 and 19.00 hours because of the extremely strong wind.

As regards the flood spillways, as was the case for the dam and the hydroelectric power plant, prefabrication techniques were used as far as was possible. The two-dimensionally curved linings of the surface spillways, the supports of the power penstocks and the crest of the dam were prefabricated and the bearing elements prestressed.

The hydroelectric power plant building had its foundations on the 'live stops' of the dam, adding its weight to that of the stops so as to improve their stability. The stops were subjected to pressure in successive stages, Three-fourths of the force exerted being applied before the fill, while the rest will only be applied when the capacity of the dam reaches half its full value.

4. *Engineering and hydroelectric equipment*

All the major equipment and material was submitted to international bidding. The characteristics of the engineering equipment, their siting in the dam and on the spillways were decided upon after tests on scale models in specialized laboratories.

Evacuation of floods, and the irrigation conduits

The yearly flow of the Sefid-Roud during rainy years can reach over 8,000 million m.^{3} Under these conditions, the major part of this flow arrives during the Spring floods in April and May, and the discharge of the excess water should be effected by the various elements provided in the dam to this purpose. Under the most unfavourable conditions, it has been estimated that 6,000 m.^{3} per sec. will have to be overflowed over the dam.

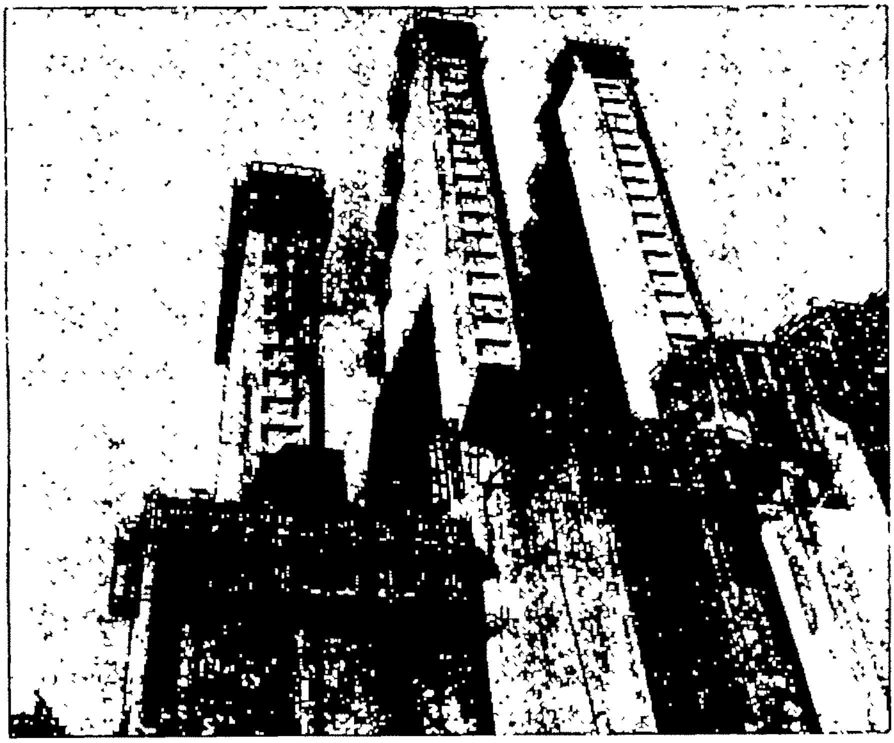

Fig. 2

Buttress heads with water take-offs for the station

At the bottom level, with a view to withdrawing a maximum flow of solid matter during flood periods from the bottom of the reservoir, 5 dewatering conduits have been installed : 3 on the right bank with a total throughput of 480 m.^{3} per sec. and two on the left bank capable of discharging 500 m.^{3} per sec. This breakdown of the bottom flow is required in order to obtain a maximum amount of lime discharge, to control the total bottom flow and to distribute the volumes of water emerging at high speed downstream. During the irrigation periods, discharges from the dam are ensured by these 5 sluices for that section of the throughput which does not pass through the turbines.

20 m. beneath the normal reservoir level, on the left bank, an under-surface spillway is fitted, with a potential throughput of 2,000 m.^{3} per sec. This spillway discharges the normal floods and enables the level of the reservoir to be easily regulated, and in particular to free one of the higher water levels so as to provide for the arrival of an exceptional flood.

Finally, on the surface, any exceptional flood can be discharged by spilling over through two tulip-section overflows, secured at the normal reservoir level (271.65 m.). These two devices, operating together are capable of discharging 3,000 m.^{3} per sec.

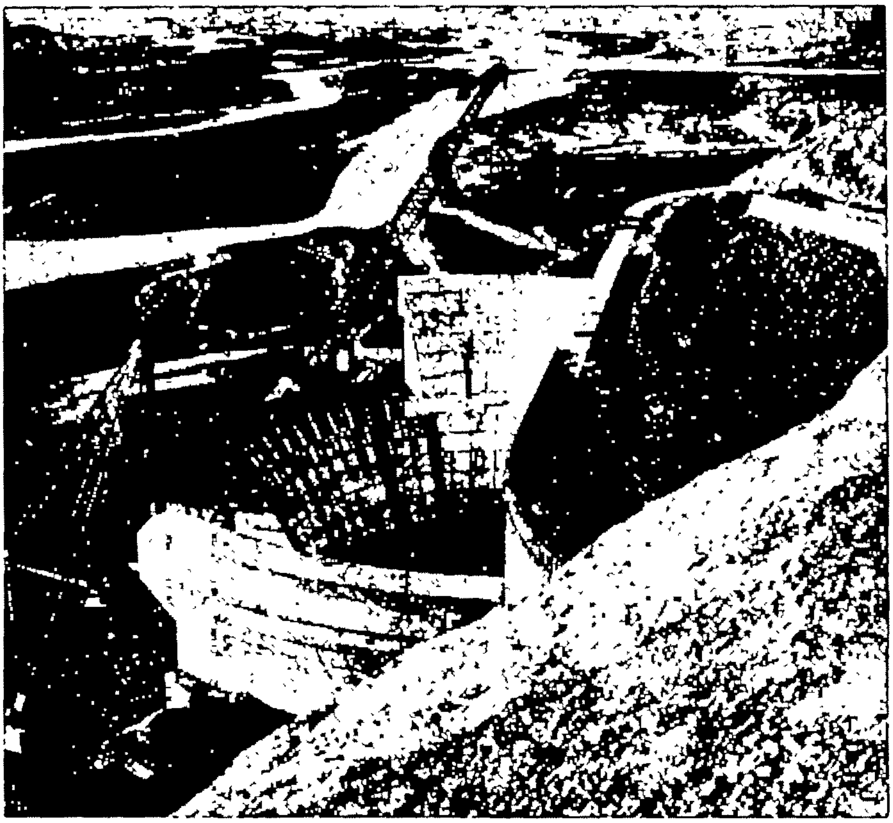

Fig. 3

The tulip form flood spillway no. 1

Hydroelectric power plant

There are many possibilities of using the head of the Menjil Dam for the production of electric power. These are of three different kinds, depending on whether they are operated either giving priority to irrigation, merely by ensuring the yearly regularization of the river, or finally by tying up the electric power producing components of the dam to other important pumping installations for the irrigation of other sites at a time when irrigation is in full activity in the Guilan plain, this irrigation being provided from already existing deep lying water deposits.

The solution chosen was that of priority for irrigation, the hydroelectric power plant at the foot of the dam devoting two 17,500 kW sets to supplying electric power to the Guilan province (it being unnecessary to provide thermal power plants in this region) and three 17,500 kW sets in order to produce during the course of the year a guaranteed peak power for the Northern Iran interconnecting network of the future.

The two turbo-alternator sets installed in the first stage are fed by two 2.40 m. diameter power penstocks, each set having a water throughput of 32.9 $m.^3$ per sec. at the maximum power of 25,500 h.p. for each Francis turbine, with a nominal head of 63 m. The rotary speed of the sets is 300 r.p.m. The A.C. generators are 3-phased, the A.C. frequency is 50 cycles, at a nominal voltage between phases of 10,600 V. The current generated is brought up to 132,000 V by two power transformers feeding the 132,000 V busbars of the outlet station on which the high tension Menjil-Recht line will be connected.

Sites for the three turbo-alternator sets of the second stage of the dam equipment are kept aside in the hydroelectric power plant building. Outside, a platform has been prepared on the right bank of the power plant so as to receive a 132,000-220,000 V transformer station and the future 220,000 V take-off points of the Menjil-Khazvin-Teheran line.

ADDRESSES OF CHAIRMEN AT THE ANNUAL GENERAL MEETINGS OF THE LOCAL CENTRES

Madras Centre

Chairman's address by Prof. A. Srinivasan, B.E., M.Sc. (Eng.), M.S., M.I.E., at the 40th Annual General Meeting of the Centre on December 22, 1962

After welcoming the Chief Guest, Shri R. Venkataraman, Minister of Industry, Madras, Prof. Srinivasan thanked the members of the Centre for having elected him Chairman for 1962-63.

Delivering the Chairman's address, he said, "We are meeting today when our country is facing a crisis. The Chinese aggression has created a situation which calls for an increased united effort of every Indian citizen. During the previous years, the Institution was playing its part by marshalling the technical knowledge and experience of its members, to ensure the best use in the country of what is undoubtedly a great national asset. National defence has presented many problems to engineers, particularly to those engaged in industrial production whose duty it is to ensure enhanced production and continuity of supplies. The continuance of the emergency will doubtless bring us many further problems, but the high standards of professional conduct and attainment found in the ranks of the Institution are the best possible assurance that all such problems will be solved successfully and that the Institution will take in the national struggle a place worthy of our great heritage.

I would crave your indulgence to permit me to dwell for a moment on the significance of the Institution in our national life. The Charter requires us as an Institution to promote the general advancement of engineering and its applications, and to facilitate the exchange of information and ideas on those subjects amongst members of the Institution. The whole machinery of the Institution is devoted to this end, an important part being the work of the Local Centres and Sub-Centres. The meetings and discussions which these Centres organize are devoted directly to the implementation of the terms of the Charter. All of us appreciate the wisdom of our predecessors in providing these facilities, which have done so much to meet the needs of the nation, as well as adding to the prestige of the Institution as a whole. But a good deal more is involved than the mere dissemination of information among our members, to say nothing of our responsibilities as a body to ensure and maintain adequate professional standards. Important and necessary as all this in the ultimate, is the collective effort of individuals which matters, and each of us has a personal responsibility to ensure that his own individual contribution to the profession is adequate in all respects. That the total contribution is substantial is reflected in the pre-eminent position which our Institution is proud to hold, but it is nevertheless the fact that this contribution comprises the strenuous efforts of only a relatively small number of members, and I would request each of you to consider whether your individual contribution to the Institution and to the development of the science in which you practise is as great as you feel it should be. We must not forget that it is the responsibility of the coming generation of engineers to see that our present status is not only maintained but improved. Their task in this respect will demand a recognition of the fact that these are days when the knowledge which is increasing rapidly in all fields of engineering and science must be matched with increased wisdom, for if these two fail to go hand in hand, disaster will eventually overtake us.

This is the age of unprecedented advance on all fronts of applied science, when so much depends upon the skill and ability of the individual. A good deal has been written and spoken in the past few years on education and training, pointing out the urgent need for a great increase in the number of adequately trained scientists and engineers. If we are to be successful, some definite course of action has to be taken. The conditions demand that the training of the potential scientist should include sufficient liberal studies to make him aware of the social and economic problems of the modern world. At the same time, he must acquire more scientific knowledge of a general character and so be able to appreciate the effects of scientific advances on modern conditions. To achieve this, a suggestion is to raise the level of science teaching in secondary schools.. It is worth the observation that in Russian Secondary Schools the three final years to age 17 include for all the study of physics, chemistry and mathematics for 40% of the time. They must pass in these subjects, as well as in the standard assortment included in the other 60% in order to enter a university. So, potential arts men answer up to science tests and potential engineers to literary tests.

The second phase in the scheme of training is the engineering education imparted in our technical schools and colleges. The experience gained has proved beyond doubt that the students response to the curricula is far from satisfactory. The foremost reason is the inadequate knowledge of English to understand the lectures and express themselves in that language. Since it has been accepted that English shall remain as the medium of instruction in technical studies, urgent steps may be taken for the improvement of English studies at lower levels With the general upgrading of instruction in mathematics and science at the high school levels, it is hoped that the collegiate education in technical subjects will be considerably improved.

There has been a phenomenal expansion of technical education all over the country. As a result of concerted national efforts made on this behalf, the number of colleges in India for the first degree courses increased to 100 with a total admission capacity of nearly 14,000 students. As compared to the conditions which existed in 1947, this represents a four-fold expansion. I venture at this stage to offer a few remarks in the matter of education for engineers, which I am afraid is a hackneyed subject. It is necessary to define clearly what is the objective of engineering education. I feel that education must have three broad aims : (i) to teach understanding of life as a whole ; (ii) to foster genius ; and (iii) to make man useful. True education must provide ready access to books of all kinds, and, particularly for engineers from their earliest years, access to men of affairs. Engineering is a live activity, and its special ideas are better developed by active inter-changes between people. Education is for the improvement of individual capabilities and the encouragement of genuine interests, not the imparting of set ideas through intermediaries. An engineer, by definition, is a useful man. He has to learn words and techniques in a wide range so that he can deal with likely situations. His education must include a wealth of established material, but this should not overwhelm the teaching. Syllabuses must not be too ambitious. The kind of instruction needed is to teach the students to use drawings, but not to train draughtsmen ; to teach students how machines are designed, not how to design them. Draughtsmen and designers are trained in the woks. The illustrative problems and exercises should be based on practice, but the memory should not be loaded with a mass of practical details and empirical data. Properly taught, engineering principles develop reasoning powers.

If a technical institution has to effectively function, the existence or the appointment of adequate, well-qualified and enthusiastic staff is as necessary as the equipments and buildings, not to mention the finance. The problem of shortage of teachers is a complex one and it has to be tackled more urgently than the problem of increasing the output of trained engineers. The shortage at present in most of the institutions is of the order of 40 to 50% of the sanctioned strength in the institutions. It is well known that it is almost impossible to attract persons with high calibre to the teaching profession. I am afraid that with the proposed plans for further expansion of technical education, the shortage of trained teachers is bound to become more acute. One need not go far to seek reasons for our brilliant young graduates in engineering shunning the teaching profession. The rapid expansion of industries, the growing awareness of industrialists of the advantages of employing persons with high academic achievements, the possibilities of acquiring special training abroad sponsored by the industries, the higher emoluments associated with such jobs, and the status and service conditions of all-India service take away all the brilliant students from the teaching profession. It is learnt that the absence of assured prospects of promotion to the higher categories in the teaching profession is lacking. While a graduate serving in the industry has got an assured future after a reasonable period of service, there is no such assurance in the teaching profession. The solution lies not only in the recruitment of qualified personnel but also to ensure that those who are recruited are retained as teachers. It is my humble suggestion that if the technical institutions are to have their full complement of staff comprising brilliant graduates, the salary scales have to be revised considerably to be on par with if not better than the all-India services. Prospects of promotion to the higher categories should be enlarged so that there is no inducement for teachers to seek jobs elsewhere. Engineering teachers may be deputed periodically to work in industries to gain practical experience and to obtain opportunities to appreciate the manifold technical problems which face the industry. Research and investigation of specific problem from industry may be referred to the technical institutions for analysis and solution. In this way, the hiatus between theoretical education and practice of engineering can be removed.

The Government of India had recently appointed a high power committee to go into the question of re-organization of the post-graduate education and training in our country and have made a comprehensive report suggesting that the period of study may be for two years instead of one year. The recommendations have been generally accepted by almost all the institutions in our country.

While it is generally conceded that engineering education shall be based upon the demands of the industry, it is seldom recognized that a close coordination must exist between the industry and technical institutions. It is only at graduate level that so much more could be done by industry. Too many firms appear to waste bright men in dull and discouraging tasks and much could be done to relieve the shortage of technologists by encouraging and trusting young men in position of responsibility. One excellent way of developing a young engineer is by providing tutors in industry who can offer guidance and experience within the environments of manufacture and research. This would offset the temptation now presented to young men to spend too long a period in the atmosphere of teaching establishments purely to obtain a higher degree in the hope of impressing a prospective employer. Only a few men have the imagination which produce these results in academic isolation. Most brilliant engineers have minds which are stimulated and developed best by creative work in a good firm.

The ever increasing demand for qualified personnel in the industry cannot be fully met by the products from engineering colleges only. A great deal of the deficiency can be made up by provision of facilities to those in industry who, by attending evening classes in recognized institutions, earn enough credit and have sufficient training to satisfy the requirements for the Associate Membership of our Institution or a diploma in technology. It is suggested that the industry may make a careful assessment of the implications of industrial training as part of the sandwich courses. These courses may be run by approved technical colleges and will lead to a diploma in technology or to the Associate Membership of the Institution. The duration of the course, of course, will be longer than the full time course. This need not be a deterrent for the students to join such courses since the students will be earning while they learn.

Industry has the task of re-educating its own engineers and some special effort is required. Refresher courses on modern topics may be arranged in the colleges which have facilities so that the engineers may be enabled to base their new ideas on the solid foundations of basic fundamentals.

Recruitment of large numbers of women to the ranks of technicians and professional engineers has to be encouraged. In a country such as ours, which still holds definite views on the scope of women's activities, such a course presents its own peculiar difficulties and requires a change in outlook among parents and teachers and in industry. It is time we ceased to fear the shadow which the wedding ring casts behind and before it. This fear is less than it used to be ; for instance, marriage is no bar to some posts. In the long run, prejudices will be overcome ; let us hope the process does not take too long, because we urgently require the skilled contribution which, I am sure, suitably trained women have it in their power to give. The step in the right direction has already been taken in Madras which has a Women's Polytechnic with a lady engineer as its Principal.

Before I conclude I wish to make a brief review of the breath-taking developments which have taken place in the field of electrical engineering and electronics abroad. Most of the investigations are directed towards the discovery of new forms of energy resources and new methods of energy conversion. The fear that the world is running short of fossil fuels, encouraged the development of nuclear power resources. Such resources being characterized by higher capital costs, the development of gas-cooled reactors with enriched ceramic fuel reveals a possibility in effecting economy. Power from the winds and tides has been recovered to some extent, but not quite appreciably. Solar power generation is very much in the news now, and considerable activity in this direction is reported from places which have adequate means. Direct energy conversion techniques have opened a vista for revolutionary changes in the manner in which energy transformation can be made with high efficiency. Some of these direct conversion techniques involving thermo-electric, photo-voltaic, thermionic, fuel cells, magneto-hydrodynamics principles will find their economic places in the energy picture of the future. Thermo-electric functions have been known for a long time, and the development of solar cell technology has led to their use in space satellites for a perpetual transmission of messages. This has been rendered possible by the discovery of the suitable nickel-cadmium battery and a reliable ceramic-to-metal seals. Fuel cells are another group which produce a direct conversion of energy from fuels to electricity. For normal temperatures, hydrogen-oxygen systems utilizing porous carbon-electrodes are being used. Re-generative fuel cells are also being developed. There have been two waves of interest in plasmas. The first wave is concerned with the statics of plasma and it resulted in the discovery of electrons, X-rays, etc. The second wave of interest is with their dynamics. The importance of the dynamics of plasmas was first recognized in astro-physics. The generation of cosmic rays and radio emission of celestial bodies have been related to ionized gases in violent motion. This dynamics of plasma has resulted in the production of magneto-hydro-dynamic generators. The standard method of electric generation is obtained by the movement of a conductor in a magnetic field. If a gas is ionized by some means, it becomes a conductor and if it is forced through a magnetic field, there will be electric power generation. Since there are no moving parts, such a generator, it is bound to be very efficient. It is expected that such MHD generators may be produced commercially in times not too far. Numerous practical applications have sprung up as a result of the development of materials technology. A device which can produce heat or cold simply by reversing the direction of current making use of the well-known principle of Peltier effect has been discovered. Thousands of such discoveries are coming out as a result of intensive investigation based on principles which have been established long ago, which prove that engineering cannot be divorced from pure science and *vice versa*. Considering the pace of research and inventions streaking past us, should we not at least get prepared even at this late stage to take a flying start to keep abreast of the developments ?

In conclusion, let me exhort the engineers, everyone of them, to mobilize their talents, place them at the disposal of the country in this National Emergency and work as a team to carry out the duties with unflinching devotion.

Poona Centre

Chairman's address by Prof. M. V. Deshpande, B.E. (Elect.), B.E. (Mech.), M.S. (Illinois), M.I.E.E., M.A.I.E.E., M.I.E., at the 4th Annual General Meeting of the Centre on January 5, 1963

After welcoming the Chief Guest, Shri S. G. Barve, the Minister for Finance, Maharashtra, Prof. Deshpande thanked the members of the Centre for having elected him Chairman for 1962-63.

Delivering the Chairman's address, he said, 'This year the Poona Centre has been given a plot of land of nearly 39,000 sq. ft. area by the Government of Maharashtra on a long term lease basis at a nominal annual rent to enable the Centre to have its own building. We are grateful to the Government of Maharashtra for this. I hope it would be possible to construct the building for our technical activities very soon.

It is customary for the in-coming Chairman to talk about some aspects of engineering with which he is acquainted and which is of current interest. I propose to deal with the subject of 'Planning for Electrical Power in India'.

The main types of power plants used for electrical power generation are steam plants, hydroelectric power plants, gas power plants and atomic power plants. In recent years there has been a lot of improvement in power plant equipment and power station practices in the world. With the development of metallurgy, boiler units giving high pressures and temperatures have been developed. For example, boiler units having 907,000 kg. per hr. (2,000,000 lb. per hr.) capacity at 168 kg. per cm.^{2} (2,400 lb. per sq. in.) pressure and 621° C. (1,150° F.) temperature are now available. With the use of economisers, air heaters and improvements in the method of fuel burning the efficiency of the modern boiler units has increased to 85 to 90%. Large size turbo-alternator sets up to a maximum of 500 MW are now available. The efficiency of turbine plants has increased to 30 to 35% in large size units. Turbo-alternators of still larger capacity even up to 1,000 MW size are being designed and would be developed in the next five years. With the development of large size boilers, unit system of operation has become possible for steam station layout. In case of hydroelectric stations the capacity of the individual power generating units is increasing, the maximum size of a unit being about 300 MW. Underground hydroelectric power stations are being used where economy and location justify this type of construction. Reversible operation of hydraulic turbine and pump units is used where the storage capacity is limited, cheap source of power is available for pumping and the site permits installation of pumping facilities from the tail race pond to the storage at the time of low load on the station. The double operation of pump-turbine unit can increase the efficiency as high as 73% and this type of plant fits in a power system economically as a peak load plant if suitable site is available. There is a trend towards building atomic power stations to preserve the conventional fuel resources. The U.K., the U.S.A., the U.S.S.R. and Canada have power stations using atomic reactors as the source of heat. The reactors used for these power stations are either natural uranium graphite moderated reactors or pressured water reactors. The range of the unit capacity in such power stations varies from 150 to 500 MW. The capital cost of an atomic power station is 80 to 100% more than a steam station of the same capacity. Atomic power stations can be used as base load stations. They are not suitable for variable load operations. In countries where gas is available in plenty gas turbine plants in some situations are the cheapest form of energy, intermittent or peak load plants for use in combination with base load plants in the system. The size of the gas plant unit varies from 10 to 25 MW, the largest size being about 50 MW. The gas plants are particularly useful and economical to supply load of load factor 15% or less. The various types of plants used for electrical power generation should be used in such a way that their combined operation would supply the load on the power system most economically.

The main resources of electrical power production in India are: hydro, coal, oil and nuclear. A survey of resources helps in planning future economic development of electrical power, the location of electro-mechanical, metallurgical and other large industries at proper places and the development of suitable electric grids. The hydroelectric power resources in India are estimated at about 41,000 MW at 60% load factor. Some of the hydro schemes are multi-purpose power schemes but the trend of major development is for single purpose power schemes situated in upper and middle reaches of the various river basins. The capital cost per kW of firm output for a single purpose hydro station in India varies from Rs. 700 to Rs. 1,700 the average being Rs. 1,000, the corresponding costs per kWh generated varying from 1.2 nP to 2 nP. The rate of coal production in India is about 55 to 60 million tons per year. The useful resources of coking coal are estimated at about 2,000 million tons and of non-coking low grade coal at about 40,000 million tons. Reserves of good quality coals of both coking and non-coking varieties are mainly confined to the Bengal and Bihar fields. Most of the coals in the fields of Assam, Orissa, Madhya Pradesh and Andhra are of inferior quality and generally have ash content of 15 to 30% and moisture content of 10 to 15%. Some deposits of lignite are found in Rajasthan and Madras State. About 40% of the coal is of good quality the rest being of poor grades. Railways and metallurgical industries consume the major portion of the coals of superior grades. Low grade coal should be used for power generation for national economy and boilers should be designed to burn low grade coal of high percentage ash content. Plants for utilization of low grade coal in electric power stations should be based on two factors : (i) the price of coal delivered at any power station should bear a relation to the effective heat content of the coal, and (ii) the quality of the coal allotted to the power stations should bear a relation to the distance over which the coal has to be transported. Pit-head stations should get the poorest quality coal. The cost of steam station is about Rs. 700 to Rs. 900 per kW and overall efficiency is about 20 to 25%. The average cost of coal is about Rs. 40 to 50 per ton. India's oil resources are very limited and Diesel stations form only 2% of the power station capacity in India. There is only a station or two working on gas turbine in Assam. Oil and gas resources have been recently found in Gujarat and are being explored and developed. Most of the resources at present will be needed for transportation and other uses. The resources of uranium in India are estimated at about 30,000 tons whereas thorium reserves are estimated at more than 300,000 tons. Power generation is therefore being planned in India using atomic power resources. The first stage would involve the use of natural uranium to produce plutonium (Pu 239) as a by product. In the second stage of development Pu 239 would be used with natural uranium in fast breeder reactors to convert thorium to uranium 233 and in the third stage, uranium 233 would be used to convert enough thorium to make up for uranium 233 burnt. When this is possible there will be cheap and abundant power by the use of atomic resources. At present it is not immediately economical and competitive to have atomic power stations compared to other thermal stations but with the possible development in stages it would eventually be cheaper. In the initial stages the cost of atomic power stations will be Rs. 1,700 to Rs. 2,000 per kW and the thermal efficiency will be about 28% at 80% load factor.

There have been rapid changes in the pattern of load growth in India. In the early stages there was a concentrated but limited utilization of electrical power in urban areas remote from hydro resources. Now industrial economy is slowly taking shape and this results in dispersal of load centres which fall within the sphere of influence of the country's hydro resources. The hydro resources in India are such that they can be considered effective at stages when demand for power increases. A year back the pattern of consumption by various categories of consumers was as follows :

(i)	Domestic—residential	.. 11.00%
(ii)	Commercial light and small power	.. 6.00%
(iii)	Street lighting	.. 1.50%
(iv)	Industrial power	.. 68.00%
(v)	Irrigation	.. 6.00%
(vi)	Traction	.. 4.00%
(vii)	Water supply and drainage	.. 3.50%

At the end of the Second Five Year Plan the installed capacity consisted of

(i)	Hydro	.. 1,850 MW
(ii)	Steam	.. 2,450 MW
(iii)	Diesel	.. 300 MW
	Total	.. 4,600 MW

These figures exclude industrial plants generating their own electrical power which was about 1,000 MW. The largest size of hydro unit used is 90 MW and the largest size of steam turbo generator is 125 MW. By the end of the Third Five Year Plan (1961-66) the installed capacity is estimated at 5,000 MW of hydro, 7,000 MW of steam, 300 MW of Diesel and 150 MW of nuclear power. The first atomic power station is being planned at Tarapore with an installed capacity of 150 MW in the first stage to be increased to 300 MW latter. A natural uranium graphite moderated reactor would be used. Planning of two more atomic power stations in India is also under consideration. There are ample hydro resources in India which are still undeveloped and depending on the load development the bulk of the future electrical energy production during the next 20 years would be obtained by building up hydro electric stations. Hydro electric stations in India need less foreign exchange equipment than thermal or nuclear plants. The recent trends in power plant installation in India have been aiming to utilize low grade coal and fuels. The Central Water and Power Commission plans and coordinates various hydro schemes in India. For thermal station planning the Coal Controllers' Organization and Fuel Research Authorities cooperate. The Atomic Energy Commission plans for atomic power stations. In India Diesel stations are used as 'nursery stations'. They are installed in small sizes and used till the load in the locality develops enough and the grid lines come nearby. The local loads are then connected to the grid lines and the Diesel plants are shifted to other sparsely populated areas located away from the grid lines. For coordination of power plants hydro and steam plants are used in combination to effect economy. Atomic power stations when built will be used as base load plants in the regional grids. The development of the various projects and their interconnection is achieved by regional grid system. In Maharashtra, Koyna project is one of the modern underground power stations in India with the initial capacity of 240 MW to be extended to 600 MW at a later stage. At Trombay, one of the new modern thermal stations, is built up to supplement the Tata Hydro electric power system.

While developing our power resources and building many power projects we cannot keep on importing the equipment from abroad. We should design and build the equipment in India itself. One of the biggest projects in this respect, the Heavy Electricals Private Ltd., has been started at Bhopal to manufacture heavy electrical power plant equipment starting with the manufacture of transformers and switchgear initially and large generating sets at a later stage. Factories are also being set up in the country to manufacture large boilers and mechanical power plant. On the utilization side, a few factories have started manufacture of electrical motors, distribution transformers, single-phase motors, fans and electrical appliances. Small scale industries are also being developed to manufacture small size equipment. If we undertake the design and manufacture of power plant equipment in India itself we can save lot of foreign exchange and will not have to depend on other countries for the supply of such equipment. It will also be a good challenge to the talent of Indian engineers which I am sure is not lacking in the country.

For our present needs and for the expected development in planning for electrical power, the basis of the engineering education has to be modified and put on a more sound footing. The curriculum for graduation in engineering should lay more stress on the fundamental approach to engineering science. For example, for a degree course in electrical engineering more emphasis should be given on the study of mathematics, physics, circuit analysis, field theory, electronics, controls, electrical machinery, electrical power stations, electrical power systems, engineering analysis and design from the basic theory point of view. Similar approach is necessary in other branches of engineering too. The time has come when we need not only operation and maintenance engineers but design and development engineers also. There is, therefore, a great need to develop post-graduate courses and research work in engineering subjects in the universities. The post-graduate courses should give stress on methods of advanced analysis and accurate measurements and presentation of thesis introducing methods of research at master's degree level and some original contribution at doctor's degree level. Higher institutions of technology have been started at four places in India to teach post-graduate courses. In addition there are also a number of institutions where post-graduate courses are already being conducted. The recent report of the Post-Graduate Committee appointed by the Government of India has laid down the principles to be followed for uniformity of standards.

For effective training of engineers there should be full cooperation between industries and engineering institutions. The industries should give facilities for training of engineering students and graduates from the various institutions during vacation periods as well as after graduation. They should run the organized training courses to make these young graduates effective to handle technical and practical problems of the industry. The industries should have their own laboratories for producing better equipment for making them competitive and economical not only for use in India but also for export. The industries should take the help of universities and research laboratories wherever possible in carrying out investigations on problems they encounter. Professors who are experts in their field of specialization should be allowed to work as consultants to the industries. This will result in mutual advantage, *viz.*, development of industries with respect to the latest research ideas and the development of applied research in universities and research laboratories in India on problems directly useful to the industries. Design and development engineers employed in private firms and industries should also be exchanged for teaching personnel so that they give benefit of their experience to engineering students.

It is now necessary to emphasize research in the various branches of engineering. For any modern development, applied research is most valuable and leads to progress. In India, National research laboratories have been started in the various fields of sciences. For engineering, recently, laboratory for mechanical engineering and research institute for power engineering have been started. At university level, it is also necessary to start nucleus of engineering research in various institutions even on a small scale in the field of specialization of the professors and the personnel available there.

In this respect I suggest planning of 'Research Units' on a small scale in specialized fields and without many duplications at suitable locations in different engineering colleges and institutions. Such a research unit will have the following advantages:

(i) It will encourage applied research in engineering utilizing the talent of expert staff in the specialized field; (ii) It will turn out engineering students with talent as post-graduate students and research students. The post-graduate students so trained will be useful to the country as engineers for design and manufacture of electrical equipment or as research workers in the particular field; and (iii) The research unit can act as a consulting body to industries and can handle problems pertaining to design, analysis and development in its field of specialization.

Quite a lot of equipment required in various engineering institutions at present needs to be imported from abroad. With the development of research and design units in a particular field of specialization it is possible to design and manufacture some of the required equipment in the institutions themselves and when properly developed it would be possible to supply the manufactured equipment to other institutions in India. This will save a lot of foreign exchange and would be a good challenge to the talent in the institutions. I, therefore, suggest that small design and manufacturing units be developed wherever possible attached to the engineering institutions for this purpose. These units would naturally need some machine tools, some extra staff, and adequately paid expert staff with the particular specialization who can be used for design, development and research purposes'.

Summaries of Papers Published in the Journal, vol. 43; no. 10 pts. PH 1, EL 5 and CH 3, June 1963

PUBLIC HEALTH ENGINEERING DIVISION

Studies on the Effect of Direct Aeration on the Improvement of Sanitary Quality of Water in Kidderpore Docks, Calcutta

I. Radhakrishnan
Non-member
and
S. Chakravorti
Non-member

This paper summarises the results obtained during the sanitary survey of the water of Kidderpore Docks, Hooghly river and boat canal. The survey was undertaken to determine the sanitary condition of dock-water so that risk of stagnation of the water could be assessed. With a view to ameliorate the insanitary conditions resulting from the stoppage of supply of make-up water to the docks, studies were carried out with a pilot aeration unit to find out the effect of direct aeration on the quality of dockwater. The results of the studies indicate that aeration lead to a considerable improvement of the quality of dockwater.

High Rate Filtration at Municipal Water Treatment Plants

S. R. Kshirsagar

Associate Member

Filtration is an important process used at municipal water treatment plants for the removal of turbidity in water which is due to very fine material in suspension (including bacteria). The rapid gravity type of filters used at present for the purpose employ a filtration rate of 80 to 100 gallons per hr. per sq. ft. of the filter bed area. This rate was decided upon some 50 years back. Now that considerable improvements have been effected in all the processes used at water treatment plants it is quite feasible to increase this design rate of filtration. This paper gives in brief the implications involved in going for higher design rates by explaining the factors affecting the process. Finally, it is suggested that higher rates be employed to obtain economy in the initial and operational cost of filter units.

Recent Advances in Public Health Engineering

N. V. Modak

Member

In this talk the author describes recent developments in Public Health Engineering in its manifold aspects.

ELECTRICAL ENGINEERING DIVISION

An Analytical Method of Testing Current Transformers

V. S. Bansal

Non-member

This paper deals with an indirect method of determination of ratio and phase angle errors of current transformers having large current ratings. Potentiometer and bridge methods are employed for the determination of the various factors affecting the errors. Finally, the limitations of the method are pointed out.

Electrical Characteristics of Steel Tubes—2

Dr. H. R. Chablani

Associate Member

Rigorous formulæ were developed in a previous paper on predetermination of electrical characteristics of steel tubes which applied to hollow conductor of any thickness. These were obtained (i) for general case of variable permeability and hysteresis, and (ii) for general case of variable permeability and hysteresis when the tube is considered as a flat strip. For the sake of ease of calculation simpler formulæ have been obtained in this paper on the basis of constant permeability and elliptical hysteresis by two different methods, *viz.*, (i) by use of Bessel functions, and (ii) by use of step by step method developed by Dwight and Arnold for non-magnetic conductors; the method being extended here to include the effect of hysteresis as well as permeability.

A Theory of Electricity and Magnetism

R. R. Karnik

Associate Member

There are certain phenomena in electricity and magnetism which, although covered and explained by the theoretical methods used by electrical engineers, do not appear to be completely represented in the Maxwell-Lorentz field equations of the electrodynamics. The intention of this paper is to point out these and suggest an alternative basis for a theory to explain them.

Residual Charge Phenomenon in Dielectrics

P. K. Sankaranarayanan

Graduate

The phenomenon of residual charge in dielectrics has attracted scientific attention since the days of the classical experiments with the Leyden jar. In spite of the various theories advanced to explain it, the phenomenon has remained unexplained till today. Nearly all the past work in this field has been devoted to a study of the residual currents and very little attention has been given to the analysis of the residual voltage. This paper has been entirely devoted to this aspect of the problem and expressions have been derived for the residual voltage based on the two-layer theory and on the superposition theory.

CHEMICAL ENGINEERING DIVISION

Design of Pulverized Coal Flames for Boilers

R. K. Chakravorti

Non-member

and

S. G. Mukherjee

Non-member

In the design of the boilers the consideration of the flame characteristics form an important part, apart from the optimum choice of convective and radiative heat transfer surfaces to give maximum amount of steam generated per unit heating surface area. The suitable volume of the furnace to accommodate the flame and the percentage of the unburnt carbon allowable to leave the boiler setting are the economic considerations. Thus the characteristics of the flame with respect to the percentage of carbon at different stages of its travel, its length, its contour, and the heat release rate of the flame are some of the considerations which are to be taken into account in the design of the flames for a particular installation. The characteristics of a coal, such as rank analysis, fusion point, etc., also play an important role but in the design of the flames the fineness of the coal as determined by the screening analysis ultimately controls the exit percentage of the unburnt carbon. An attempt has been made in this paper to characterise the pulverised coal flame with respect to its length, shape and the inclination of the burner. The effect of the fineness of the coal on the performance of the flame is also discussed.

INSTITUTION NOTICES

Revised subscriptions

The following revised subscriptions, entrance fees, transfer fees, will take effect from Institution year 1963-64, commencing September 1, 1963.

Member	Rs. 80
Associate Member	Rs. 50
Companion	Rs. 100
Affiliate Member	Rs. 50
Graduate	Rs. 40
Student	Rs. 35
Subscriber	Rs. 250

Also, a 50% increase against all grades for entrance fees, transfer fees, and registration fees.

The above new rates were adopted at the Meeting of Corporate Members held in New Delhi on March 31, 1962. Minutes of that Meeting were confirmed at the 43rd Annual General Meeting held in Bangalore on May 18, 1963.

Application forms for Sections A and B of the Associate Membership Examination to be held in November 1963

Application forms for Sections A and B of the Associate Membership Examination (existing scheme) to be held in November 1963 are attached to this issue of the *Bulletin*. The programme of the examinations and the detailed instructions are also attached with the application forms, and they may be detached for reference, if so desired. All these forms, the programme of examinations and the detailed instructions are **printed on white paper** to distinguish them from those applicable to the new scheme which are printed on pink paper. Students are notified that no further application forms will be distributed to them.

Applications complete in all respects and accompanied by examination fees for admission to the November 1963 examinations and two copies of passport size photograph pasted in the spaces provided on the application form should reach the Head Office before 4.00 p.m. on Monday, September 16, 1963.

Application forms for Sections A and B of the Associate Membership Examination (New Scheme) to be held in November 1963

Application forms for Sections A and B of the Associate Membership Examination (new scheme) to be held in November 1963 (**printed on pink paper**) are attached to this issue of the *Bulletin*. The programme of the examinations and the detailed instructions (**printed on pink paper**) are also attached with the application forms and they may be detached for reference, if so desired. Students are notified that no further application forms will be distributed to them.

Draft Indian Standard

The following draft Indian Standard has been issued recently.

Draft Indian Standard Recommendation for Preferred Dimensions for Storey-Heights—BDC 10.

This Standard lays down recommendation for preferred dimensions for storey-heights.

Members may send their comments on the above draft Standard before September 14, 1963, to Shri T. R. Mehandru (*M.*), 14 Asaf Ali Road, Ajmeri Gate Extension, New Delhi, who is the Institution Representative on the Sectional Committee dealing with this Standard.

Copies of the draft Standard may be obtained from the office of the Indian Standards Institution, 9 Mathura Road, New Delhi; or from its branch offices at 232 Dr. Dadabhoy Naoroji Road, Bombay 1; 11 Sooterkin Street, 3rd Floor, Calcutta 13; 54 General Peters Road, Madras 2; or 14/69 Civil Lines, Kanpur.

FORTHCOMING CONFERENCES

Colloquia to be organized by RILEM

The Commission Permanente of RILEM has agreed to hold future colloquia as given in the following programme. Members who wish to have further information should contact the appropriate organizing body whose addresses are also given against each.

Subject	Date	Organizing Secretaries
1. Measurement of Dynamic Loads and Vibrations in Structures	July 7-11, 1963	Secrétariat due Comité d' Organization du Colloque RILEM 1963 Institut de Recherches Scientifiques et Techniques du Bâtiment et de la Construction de Hongrie, Dioszegi Ut 37, Budapest 11, Hungary

2. Small-Scale Models of Dams	October 14-19, 1963	Laboratorio Nacional de Engenharia Civil, Avenida do Brasil, Lisbon, Portugal
3. Behaviour and Durability of Building Materials in Hot Countries	November 1963	Colloque RILEM 1963 Direction Générale de la Recherche des Fédérations du Bâtiment, et des Travaur Publics, 12 rue Brancion, Paris 15, France
4. Application of Advanced and Nuclear Physics to the Testing of Materials (RILEM/ASTM)	February 3-6, 1964	Mr. T. A. Marshall, Jr., Executive Secretary ASTM, 1916 Race Street, Philadelphia 3, Pennsylvania, U.S.A.
5. Transfer of Water in Porous Bodies	April 1964	Colloque RILEM 1964, Direction Générale de la Recherche des Federations du Batiment et des Travaux Publics, 12 rue Brancion, Paris 15, France
6. Accelerated Hardening of Precast Reinforced Concrete	July 1964	Professor M. Mironov, Academy of Architecture and Building, Pushkinskaya 24, Moscow, U.S.S.R.
7. Research and Acceptance Testing of Synthetic Materials Used in Building	1964	Comite Organisateur du Colloque RILEM 1964, Institut du Genie Civil, 6 Quai Banning, Liège, Belgium
8. Concrete in Sea Water	May 1965	Mr. Gambino Amato, Universita di Palermo, Facolta di Ingegneria, Via Maqueda 175, Palermo, Italy
9. Problems of Moisture in Buildings (RILEM/CIB)	1965	The State Institute of Technical Research, Lönnrotinkatu 37, Helsinki, Finland

Symposium on 'Design and Construction of Weirs and Spillways', Osmania University, Hyderabad, August 2-3, 1963

A Symposium on 'Design and Construction of Weirs and Spillways' will be held at the College of Engineering, Osmania University, Hyderabad, from August 2 to 3, 1963.

36th Annual Meeting of the Water Pollution Control Federation, Washington, October 6-10, 1963, and Honolulu, October 14-16, 1963

The 36th Annual General Meeting of the Water Control Federation will be held in Washington, U.S.A., from October 6 to 10, 1963, and in Honolulu, Hawaii, U.S.A., from 14 to 16, 1963. A comprehensive programme covering all phases of water pollution control is arranged. The technical sessions to be held in Washington will include the presentation of over 70 technical papers and discussions. At the reconvened session in Honolulu, design of wastewater treatment facilities in the Honolulu area, pollution control programme and problems in the State of Hawaii will be discussed. Inspection trips are planned to include wastewater treatment facilities in the Honolulu area and Pearl Harbour.

Further details of the meeting may be had from Water Pollution Control Federation, 4435 Wisconsin Avenue, Washington 16, D.C., U.S.A.

Conference on 'Development of Fertilizer Industry in Asia and the Far East', Bombay, November 18-December 2, 1963

The Conference on 'Development of Fertilizer Industry in Asia and the Far East' will be held in Bombay from November 18 to December 2, 1963. In view of the importance of fertilizer industry to the development programme of countries in the region, the Economic Commission for Asia and the Far East (ECAFE) recommended that a regional Conference should be convened to promote the development of this key industry. It was further suggested that the scope of the Conference should be broadened to cover, among other things, the technical and economic aspects of nitrogen and related industries. In pursuance of the above recommendations, the ECAFE Secretariat, the United Nations Centre for Industrial Development and the Bureau of Technical Assistance Operations of the United Nations Department of Economic and Social Affairs, jointly with the Food and Agriculture Organization (FAO), have undertaken the preparations for holding a Conference on the development of fertilizer industry in Asia and the Far East.

The Conference is intended to bring together, in addition to the international experts appointed by the United Nations, national experts in both governments and industries from member countries both within and outside the region, in order to:

(1) Assess the present and future demand for chemical fertilizers in the region;

(2) Analyse the region's existing capacity to manufacture chemical fertilizers and the present and future needs for developing that capacity;

(3) Appraise the adequacy of raw material resources for maintaining the necessary development of these industries;

(4) Examine the comparative investment and production costs for different types of manufacturing processes and sizes of plants;

(5) Suggest the types of manufacturing processes and sizes of plants which may be best adapted to countries of the region; and

(6) Recommend the specific national or international measures needed to expedite the development of fertilizer industries in the region.

It is proposed that the Conference should give special attention to the promotion of measures which will facilitate a flow of the capital, technical know-how and equipment required for the development of fertilizer industries. For this purpose, participants from countries of the region are invited to send to the secretariat in advance, or to bring with them at the time of the meeting, details of any specific economic, financial or technical problems connected with the development of these industries or with the selection and use of fertilizers in their countries, for discussion or individual consultation with the United Nations or national experts of the Conference. Furthermore, those participants who are seeking technical assistance or joint venture arrangements for the development of fertilizer industries in their countries may also avail themselves of this opportunity to discuss the proposals with other participants concerned.

The participants and interested members may contribute papers on the following subjects :

(i) Anticipated requirements of chemical fertilizers in the region up to 1975,
(ii) Development of nitrogen industry in the region,
(iii) Development of the phosphatic fertilizer industry in the region,
(iv) Development of potash fertilizer industry in the region,
(v) Technical and economic aspects of manufacture of mixed fertilizers in the region,
(vi) Storage, packaging, handling and transportation of fertilizers,
(vii) Fertilizer plant and equipment manufacture in the region,
(viii) Development prospects and investment needs in the region, and
(ix) International and regional cooperation in the development of fertilizer industry.

Further details of the Conference can be had from The Chief, Industries Division, United Nations ECAFE, Bangkok, Thailand.

Afro-Asian Housing Congress,
Cairo, December 7-12, 1963

The Afro-Asian Housing Congress, sponsored by the Egyptian Society of Architects, will be held in Cairo from December 7 to 12, 1963. The theme of the Congress will be 'Human Progress through Better Housing'.

The following subjects will be discussed at the Congress :

1. *Building industry*

Local building materials and their most efficient use

Improvement of building materials

Improvement of building methods : large scale methods, prefabrication, mechanization, etc.

Organization of the work site, national utilization of the labour force, and raising of management capacities

Housing furniture and equipment

2. *Economic and legislative policy*

Competent authorities to finance housing projects : Central Government, Local Governments, municipalities, cooperative societies, building corporations, industrial and agricultural organizations (as regards employees' housing scheme)

Methods of financing housing projects ; direct financial assistance, loan facilities and refund loans, guarantee of payment of rents

Legislation and the national housing programme ; giving higher priority to housing projects for medium and low income groups, restrictions on luxurious buildings, expanding the resources of the building industry, etc.

3. *Main principles of housing schemes*

Dwellings : minimum requirements, specifications of building materials used, dimensional standards, categories of house, number of storeys, allowed density, etc.

Distribution of public buildings ; schools, health establishment, administrative buildings, public libraries, shopping centres, etc.

Circulation : main thoroughfares, intercommunication streets, etc.

Recreation facilities : sports grounds, clubs, cinemas, theatres, assembly halls, parks, gardens, etc.

Circulation : main thoroughfares, intercommunication streets, public transport, etc.

Planning of new housing areas in urban and rural regions : ruling conditions, principles to be applied, aesthetics, location in relation to existing industrial centres and agricultural regions, etc.

Replanning or remolding of existing housing areas in urban and rural regions, and in what circumstances would this be preferable to creating new housing areas.

Further details of the Congress can be obtained from Architect A. Zanfali, Executive Secretary, c/o Ministry of Housing and Public Services, Cairo, Egypt, U.A.R.

BOOK ACKNOWLEDGMENTS

1. **Irrigation Engineering.** S. R. Sahasrabudhe. *Katson Publishing House, Lucknow.* Rs. 12.50. 458 pages.

This book is intended to serve as a text-book for degree and diploma students of engineering. The subject is developed from elementary principles to give a clear grasp of the subject to the readers. Design, construction and maintenance aspects of irrigation engineering are emphasized in this book.

2. **Problems in Theory of Structures.** M. S. Divan. *Orient Longmans Ltd.*, Rs. 14.00. 410 pages.

The problems in this book cover the syllabus in the theory of structures for degree and professional associate membership examinations. The theory concerning the relative topic has been dealt at the beginning of each chapter. Most of the problems solved in the book have been selected from the question papers set for the Associate Membership Examination of the Institution of Structural Engineers, London. To drive home the theoretical aspects as well as the solution of the problems a number of diagrams have been included.

3. **Materials of Construction.** R. S. Deshpande. *United Book Corporation, Poona*, Rs. 7.50. 7th edition. 343 pages.

Designed to serve as a text-book on the subject for students of degree courses and professional institutions, this seventh edition of a book includes recent developments in metallurgy, plastics, glass, ferrous and non-ferrous metals and their alloys, heat insulating, magnetic, electric and industrial materials with a number of illustrations. Chapters on 'Petroleum', 'Magnetic and Electric Materials', and 'Miscellaneous Materials', included in this edition enhance the utility of this publication.

4. **A Treatise on Building Construction.** R. S. Deshpande and G. V. Vartak. *United Book Corporation, Poona*, Rs. 10.00. 9th edition. 400 pages.

This revised and ninth edition of a book has been primarily written to cover the syllabi for the degree courses in civil engineering of the Indian universities. In addition to meeting the requirements of most of the professional examinations and Government and State institutions, the book is useful to practising engineers as well. The chapter on 'Structural Steel Work' has been enlarged and the one on 'Acoustics' has been entirely rewritten with detailed design aspects of open air theatres, concert halls, broadcasting stations, etc. Numerous illustrations provided will surely make the book an invaluable one for students as well as practising engineers, and more so, because the authors have kept in view the Indian conditions which influence building methods and construction, such as climatic conditions, social habits, and availability of materials.

5. **A Text-Book of R.C.C. Design.** R. S. Deshpande. *United Book Corporation, Poona*, Rs. 12.00. 5th edition. 381 pages.

This book covers the entire syllabus in R.C.C. prescribed for degree and diploma courses of Indian universities. The current practice in foreign countries has also been included. Explanatory notes written in a lucid style, illustrative examples, and a number of useful tables included will make the subject easy to follow. The text of this edition has been entirely adapted to the metric system. Chapters on 'Plastic Theory', 'Prestressed Concrete', and 'Shell Roof Construction' have been completely rewritten in this fifth edition.

6. **Water Supply Engineering.** R. S. Deshpande. *United Book Corporation, Poona*, Rs. 6.50. 3rd edition. 196 pages.

This third edition of a book is intended to serve as a text for students of degree and diploma courses of Indian universities. Almost all the developments that have taken place in the field of water purification and sterilization in recent years have been briefly dealt with and a number of problems with their solutions have been included in this revised edition. Every problem in designing a water supply project has been worked out for the guidance of students. Comprehensive and precise subject matter on underground resources of water is of special interest in this enlarged edition.

7. **Applied Mechanics Through Worked Examples.** Mrs. Ila Mozumdar (Ghose). *Rainbow Book Co., Delhi* 6. 368 pages.

This book contains a wide variety of worked examples and is primarily intended to help diploma students and degree course students of Indian universities studying for engineering. Wherever practicable the topic has been developed from fundamentals while solving the problems.

8. **Microbiology for Sanitary Engineers.** R. E. McKinney. *McGraw-Hill Book Co. Inc.*, $ 9.75. 293 pages.

The first part of this book deals with the various micro-organisms of interest to the sanitary engineer and a detailed exposition of the biochemistry of these micro-organisms. The second part of the book starts with water, its sources, contamination, treatment and distribution. Chapters on 'Liquid Wastes', 'Industrial Wastes', 'Stream Pollution', and the different methods of treatment and disposal of wastes, specially of refuse and radioactive wastes, will be of special interest to sanitary engineers. The book will be of much use not only to students and practising sanitary engineers, but also for major industries with waste disposal problems, city and state health agencies, and consulting engineers.

9. **Principles of Air Conditioning.** P. M. Patel and A. K. Mehta. *Allied Publishers Private Ltd., Calcutta.* Rs. 22.50. 247 pages.

The book covers all the fundamental aspects of the theory and practice of air conditioning. Basic principles of thermodynamics, heat transfer and fluid flow have been dealt in more detail than the construction aspect of the equipment used. Subject matter on design of duct and air distribution will be of much interest to students as well as practising engineers. The last four chapters precisely deal with control applications of air conditioning instruments and servicing psychometric charts and standard air tables have been included in this book.

10. **The Indian Electricity Rules, 1956.** S. L. Bahl. *Mercantile Law Publishers, Agra*, Rs. 12.50. 122 pages.

This book contains all rules as amended up-to-date framed by the Central Electricity Board in exercise of the powers conferred by Section 37 of the Indian Electricity Act, 1910 (IX of 1910) with short comments and the case law brought up to October 1962.

11. **Who's Who in Indian Engineering and Industry.** Edited by H. Kothari. *Kothari Publications, Calcutta*, Rs. 30.00. 260 pages.

This book contains skeleton biographical sketches of leading architects, engineers, geologists, scientists, etc., in the country. Separate sections on 'Employers and Trade Organizations' and 'Professional and Scientific Organizations' have been included in this book. A list of foreign professional institutions too has been given in this publication whose usefulness is enhanced by the special index given at the end which lists almost all the technical experts in the country.

12. **Examples in Engineering Science.** G. D. G. Aston and D. R. L. Smith. *Blackie & Son Ltd., London.* 7s. 6d. 103 pages.

This book on engineering science provides a fairly wide selection of examples on elementary mechanics both worked and unworked; and each chapter is preceded by definitions, formulæ, and principles with which the student should be familiar. Almost all the examples are taken from the examination papers of the principal examining bodies conducting the Ordinary National Certificate Examination in the United Kingdom.

13. **A History of Mechanical Engineering.** A. F. Burstall. *Faber and Faber,* 50s. 456 pages.

This book makes mention of great many machines and mechanical processes used in Egypt, China, Mesopotamia, Greece, Rome and the Arab world. The nine chapters in the book deal with mechanical engineering developments in the successive periods of history. The periods become shorter as we approach the present day and the pace of advance accelerates. Each chapter includes sections on (i) materials available to the mechanical engineer, (ii) tools, (iii) mechanism and machines for the mechanical transmission of power and motion, (iv) fluid machinery, and (v) heat engines. General comments on the state of science and civilization at each period precede these sections. An account of the foundation and growth of application of the sciences of thermodynamics, mechanics and metal cutting, and of the development of automatic control mass production and aeronautics has been included in the book.

14. **Mechanical World Year Book 1963.** *Emmott & Co. Ltd.,* 6s. 76th edition. 362 pages.

This book in essence is a collection of mechanical engineering notes, specifications and tables and data. New topics such as 'Plastics as Engineering Materials' and tables on 'Centre of Gravity of Plane Figures and Sections' have been included. The section on 'Precision Measurement' which appeared in the 1961 edition has been reintroduced in this year's edition.

15. **Grinding Wheels and Machines.** P. S. Houghton. *E. & F. N. Spon Ltd.,* 63s. 382 pages.

The treatment of the subject of grinding techniques and machines in this book will give the engineer a deeper knowledge and a better understanding of the topic. Every aspect of grinding from the requirements of a good grinding wheel, its manufacture, technique of application, to grinding costs and estimating has been lucidly dealt with in this book. Because of the vast application of grinding wheels and abrasives in modern industry, the book should be of use to mechanical engineers, as well as production, planning, and time and motion study engineers, rate fixers and cost estimators in the wide and important sections of industry using machine tools.

16. **Engineering Design—a Systematic Approach.** R. Matousek. *Blackie & Son Ltd.,* 45s. 264 pages.

This book will provide guidance to engineering students, and design engineers in the art of engineering design. It has been written with a view to the requirements of general mechanical engineering design. The presentation is readily understandable and is in a systematic manner which will enable beginners in practising design problems to reach his objective by rational routes.

17. **Engineering Thermodynamics.** E. F. Pickerill. *Cleaver-Hume Press Ltd., London.* 32s. 6d. 308 pages.

This book lucidly explains the principles and engineering thermodynamics with emphasis on the energy equation. Most of the examples are original compilations from data provided by various industrial organizations. They are well chosen so as to provide the student with a basic knowledge of the theorical and basic aspect of the subject.

18. **Electrical Year Book 1963.** *Emmot & Co. Ltd.*, 6s. 56th editon. 362 pages.

This book is made up of a collection of electrical engineering notes, rules and tables and data. The sections on power factor correction and electric braking and inching have been revised. New information on the effects on motors of changes in electricity, and metal rectifiers has been included in this year's edition.

PUBLICATIONS RECEIVED

A copy of the Proceedings of the Symposium on 'Timber and Allied Products' published by the National Buildings Organization, Government of India, New Delhi, has been received. The publication contains 54 papers presented and discussed in four technical sessions on the following subjects: (i) Availability, silviculture and methods of improving the quality of various species of building timbers and bamboos, (ii) Extraction, transportation and storage of timber, timber components and bamboos, (iii) Conversion, identification and defects in timber, (iv) Composite wood, building boards and finishing of wood, (v) Seasoning and preservation of timber, (vi) Principles in design for ensuring durability, economy, maximum comfort and efficiency for acoustic insulation and comfort, (vii) Quality control, grading and standardization of timber building components, (viii) Training of wood technologists, and (ix) Use of timber in connection with industries.

A copy of the 'Administration Report for 1961-62' has been received from the Water Works Department of the Corporation of Madras. The publication contains a number of statements and graphs showing details of expenditure on water supply, capital works, rainfall, important chemical and bacteriological examination of water, etc., of the Water Works Department.

A copy of a publication entitled 'C.W. and P.C. Manual—Accounts, Works, Cash, Budget and Powers' has been received from the Central Water and Power Commission, Government of India. The Manual has been divided into five chapters dealing with (i) accounts, (ii) cash and security deposits, (iii) budget, (iv) powers and (v) works.

A copy of a Publication No. 70 entitled 'Symposium on Energy Dissipators' has been received from the Central Board of Irrigation and Power, New Delhi. The publication contains the proceedings of a Symposium held in July 1955 and the 14 papers read and discussed.

A copy of the 'Annual Report of the Chief Inspector of Mines' has been received from the Ministry of Labour and Employment, Government of India. The publication contains the report on the administration of the Mines Act 1952, for the year ending December 31, 1961.

A copy of a Publication No. 68 entitled 'Annual Report (Technical) 1958' has been received from the Central Board of Irrigation and Power, New Delhi. This voluminous publication contains a list of the meetings of the Board and Committees, summarized reports of the various research stations, technical papers and proceedings and other activities of the Central Board of Irrigation and Power.

A copy of the Proceedings of the Conference on 'The Impact of Research on Building Industry' has been received from Sahu Cement Service, New Delhi. Held at the Central Building Research Institute, Roorkee, the Conference received 20 technical papers for discussion. The book contains the papers and discussions.

A copy of a publication entitled 'Textile Industry in U.S.S.R. and Czechoslovakia' has been received from the National Productivity Council. The book contains the report of the Indian Textile Industry Productivity Team which visited the U.S.S.R. and Czechoslovakia, dealing with management, labour and industrial relations, technical education, training, research and quality control spinning, weaving and chemical processing.

A copy of a publication entitled 'Bridges of Calcutta and Its Surroundings' has been received from the Technical Journals of India Private Ltd., Calcutta. The book contains illustrations and details of the several bridges in and around Calcutta.

A copy of a publication, Bridge Series No. 2, entitled 'Records to be Maintained for Bridge Sites' has been received from the Public Works Department, Uttar Pradesh. The publication is the outcome of the recommendations of a Sub-Committee formed by the Chief Engineer of the P.W.D., consisting of officers having field experience in bridge construction.

A copy of the Platinum Jubilee Commemoration Volume of the Victoria Jubilee Technical Institute, Bombay, has been received from the Principal and Secretary of the Institute. The publication contains the messages of important personalities, a short history of the Institute, and articles of general interest.

A copy of the Publication No. 71 entitled 'Symposium on Economic and Optimum Utilization of Irrigation Supplies', in two parts, has been received from the Central Board of Irrigation and Power, New Delhi. The first part of the publication contains a report on measures to accelerate utilization of irrigation water. The second part contains the papers presented at the Symposium and the discussions that followed.

CORRIGENDUM

TO VOL. 12, NO. 7, MARCH 1963

Page 50, instead of '38119 Renganathan Narayanan', please read '38119 Raman Narayanan'.

OBITUARY

Shri P. L. Pahwa

The sympathy of the Institution is extended to the relatives of those whose passing is recorded here.

Shri P. L. Pahwa, M.I.E., died in Jaipur, in October 1962, at the age of 54.

Born in 1908, Shri Pahwa received his science education at the Edinburgh University. After having served eight months of apprenticeship in the Irrigation Department of the former Bikaner State, he was absorbed as Assistant Engineer in 1932. He became Executive Engineer in 1946 and was promoted to Superintending Engineer in 1956. During his professional career, he was responsible for the survey of the Rajasthan-Bhakra area, design and construction of earthen and lined channels with regulation, cross drainage works, syphons, aqueducts, etc., maintenance and remodelling of the Morel dam and spillway.

Shri Pahwa joined the Institution as Member in 1958.

Shri K. S. Mukherjee

Shri Kali Sahaya Mukherjee, B.Sc.(Hons.), B.Sc.(Eng.), M.I.E., died in Calcutta in December 1962, after a short illness. He was 60.

After graduation from St. Xavier's College, Calcutta, in 1920, Shri Mukherjee obtained the B.Sc.(Eng.) degree in Electrical Engineering from the Banaras Hindu University in 1924. He had training with the Calcutta Electric Supply Corporation, Tata Iron and Steel Works and the ex-Eastern Bengal Railway. In 1930, he was Assistant Electrical Engineer, ex-Eastern Bengal Railway, and was responsible from the design and erection of 4 Diesel electric generating stations and operations and maintenance of two thermal power stations. As District Engineer since 1940, Shri Mukherjee was connected with the design, estimation and erection of three boilers, turbo generators, underground and overhead distributions and other wiring installations for remodelling the Saidpur Workshop.

Shri Mukherjee joined the Institution as Associate Member in 1930 and was transferred to Member in 1948.

Shri R. Dwaraka Pershad

Shri R. Dwaraka Pershad, B.A., B.E., M.I.E., died in January 1963.

Born in 1906, in Hyderabad, he obtained his B.A. Degree from the Madras University in 1930, and passed the B.E. Degree course of the Osmania University in 1933. After having worked as apprentice for a year, he joined the Hyderabad Construction Co. Ltd., in 1955, as Resident Engineer and was responsible for the construction of various types of buildings in the Hyderabad State. He joined the Nizam Sugar Factory in 1946 as Assistant General Manager and in 1949 he was Secretary, Singareni Collieries Co. Ltd., which office he held until his death. During this period, he was responsible for the expansion of the Colliery and the construction of a power house for additional supply.

Shri Dwaraka Pershad joined the Institution as Associate Member in 1943, and was transferred to Member 1956.

Shri P. C. Vasandani

Shri P. C. Vasandani, B.Sc.(Eng.), M.I.E., died in Indore early this year at the age of 50.

Born in 1913 and educated in Bombay, Shri Vasandani obtained the B.Sc.(Eng.) Degree from the Banaras Hindu University in 1937. He had training with the Tata Iron and Steel Works, Jamshedpur, and the Dock Engineering and Welding Works, Karachi. In 1938, he joined Dalmia Cement Ltd. as Junior Engineer and was responsible for the erection and maintenance of cement manufacturing plant and steam turbine and high pressure steam boilers. In 1942, he joined the N.E.D. Engineering College, Karachi, as Lecturer in Mechanical Engineering. During 1945-48 he was Lecturer in the College of Engineering, Poona, and during 1948-49 as Lecturer in Mechanical Engineering, College of Military Engineering, Poona. He then joined the Shri Govindram Seksaria Technological Institute, Indore, as Professor of Mechanical Engineering which position he held till his death.

Shri Vasandani joined the Institution as Associate Member in 1945, and was transferred to Member in 1961.

LIST OF NEW ELECTIONS AND TRANSFERS

(Continued from Bulletin for May 1963)

MEMBERS

No	Name	No.	Name
2605	Bais, Ram Singh*	2610	George, Prof. Thommen Chempakanalhur*
2606	Sundara Rao, Col. Chaganti*	2611	Sahi ,Col. Gurbax Singh*
2607	Sinha, Col. Jamna Narain*	2612	Sareen, Ram Pershad*
2608	Singh, Brig. Shiv Dial*	2613	Sharma, Ram Kumar*
2609	Datta, Lt.-Col. Manjan Mukul*	2614	Thakoor, Govind Dadoba

* Transferred from Associate Member

MEMBERS (contd.)

No.	Name	No.	Name
2615	Orton, Clifford Austin	2644	Chopra, Dina-Nath*
2616	Cornish, Ronald James	2645	Bapat, Vaman Pandurang
2617	Halbe, Dhundiraj Narayan*	2646	Sheth, Chimanlal Chunilal*
2618	Iyengar, Nuggehalli Sampath*	2647	Mitra, Sudhanshu*
2619	Bose, Bhupendra Nath*	2648	Patro, P. Ramchandra
2620	Banerji, Profullo Kumar*	2649	Padhi, Sitaram*
2621	Sagoo, Puran Singh*	2650	Roy, Manmotha Nath
2622	Virabhadra Rao, Mandalika*	2651	Sen, Praphulla Kumar*
2623	Nath, Brig. Man Mohan*	2652	George, Prof. Mavelil Titus*
2624	Goyal, Krishna Chandra*	2653	Vaidya, Gajanan Maheshwar*
2625	Patel, Mohanbhai Dahyabhai*	2654	Mehta, Amar Sinha*
2626	Khanna, Ramji*	2655	Vedamanikam, Frank John
2627	Saigal, Balbir Singh*	2656	Reddy, Boodugula Narasimha*
2628	Das, Swarnendu Kumar*	2657	Bose, Binayendra Mohan*
2629	Srivastava, Chandrika Prasad*	2658	Sen, Nihar Kanta
2630	Sharma, Ram Nath*	2659	Das Gupta, Sukumar*
2631	Pillai, Rajagopala Ramchandra	2660	Goel, Parshotamlal*
2632	Chaturvedi, Ram Nath*	2661	Paintal, Col. Jitindar Singh
2633	Sahgal, Harish Chandra*	2662	Mukherjee, Debi Prosad*
2634	Chawla, Prakash Dev*	2663	Satsangi, Kanti Chandra*
2635	Iyer, Bangalore Subba Raju*	2664	Khosla, Lt.-Col. Kishori Lal*
2636	Balkishen	2665	Kulkarni, Vasant Subrao*
2637	Mathew, Muttathottil Pailo*	2666	Sinha, Satyadeva Narain*
2638	Harparshad*	2667	Tewari, Cdr. Lakshmi Dat*
2639	Das Gupta, Ajit Kumar	2668	Narasimhaiengar, Nuggehalli*
2640	Desikan, V.S.*	2669	Majumdar, Benoyendra*
2641	Johar, Lt.-Col. Inder Jit Singh*	2670	Bhandari, Shanti Chand*
2642	Basu, Hemanta Kumar*	2671	Mahalingam, Nachimuthugounder*
2643	Sen, Prof. Gopal Chandra*		

ASSOCIATE MEMBERS

No.	Name	No.	Name
10285	Venkatesham, Nagavalli	10296	Shrotriya, Madhav Vinayak
10286	Patankar, Prabhakar Ramchandra	10297	Chavada, Vithaldas Khushaldas
10287	Subramaniam, Pallasena Krishnaiyer	10298	Pandit, Prabhakar Shridhar
10288	Patel, Madhusudan Ishverbhai	10299	Rao, Basettihalli Krishnamurthyrao Raghavendra
10289	Dash, Baikuntha Nath	10300	Kapoor, Flt.-Lt. Kailash Chander
10290	Dharmadhikari, Vaman Vasudeo	10301	Hiranya, Narasingarao
10291	Nagaraja, Narayanarao	10302	Subramanian, Seevalaperi Muthusamy
10292	Iyengar, Yelwal Venkatachar Seetharam	10303	Seshagiri Rao, Kompella Venkata Subrahmanya ‡
10293	Lal, Maj. Girish Behan	10304	Sharan, Shitala
10294	Mohan, Capt. Avinash Chandra		
10295	Singh, Capt. Daljit		

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* Transferred from Associate Member

‡ Transferred from Graduate

ASSOCIATE MEMBERS (*contd.*)

No.	Name
10305	Sreenivasa Murthy, A. K.
10306	Sharma, Santosh Kumar
10307	Shanbhag, Shrinivas Ramanath
10308	Vaidya, Prabhakar Shripad
10309	Padmanabhan, Hariharaiyer
10310	Natarajan, Rameswamy
10311	Puri, Capt. Indra Jit
10312	Chopra, Krishan Sarup
10313	Raghavan Nair, Chomacheri
10314	Ghosh, Tushar Kanti
10315	Suryanarayana Sastry, C. V.
10316	Rajendra Nath
10317	Menon, Kavungal Gangadhara ‡
10318	Malhotra, Ramesh Kumar
10319	Rao, Dibbur Suryanarayanrao Satyanarayana
10320	Rege, Sitaram Pandurang
10321	Rajagopalan, Balasubramaniam
10322	Reddi, Maremreddi Lakshminarasa
10323	Chitale, Madhav Atmaram
10324	Shah, Champaklal Purushottamdas
10325	Menon, Marath Raman Kutty
10326	Dutt Roy, Mati Lal
10327	Ganguli, Pinaki
10328	Chanda, Hiranmoy
10329	Bedi, Mahendra Singh ‡
10330	Khanooja, Dr. Amar Singh ‡
10331	Sethi, Maj. Amar Nath
10332	Khan, Akbar Yar
10333	Sankaranarayanan, T. S.
10334	Bedi, Maj. Tanbir Singh
10335	Sarkar, Himanshu Shekhar
10336	Pimparkar, Sitaram Dattatriya
10337	Kothari, Kasturchand Manikchand
10338	Prasada Rao, Chitti Venkata Subrahmanya Lakshmi Satyanarayana
10339	Sampat, Jayant Mohanlal
10340	Anwar, Malayalam
10341	Rajaraman, Ramamrithamiyer ‡
10342	Roy, Jagadindra Nath
10343	Khan, M. Misbahuddin
10344	Chaudhari, Lalit Mohan
10345	Nagaraja, J. V.
10346	Gupta, Mohinder Paul ‡
10347	Rath, Sudarsan
10348	Aditya, Sambhu Nath
10349	Venkatraman, Nana Kothandaram ‡
10350	Sharma, Laxmi Lal †
10351	Chakraborty, Sudhansu Ranjan
10352	Bansal, Capt. Santosh Kumar
10353	Iyer, Raja Ananthanarayanan
10354	Sarkar, Bhabani Prosad
10355	Bansal, Jagdish Chander
10356	Shastri, Mantravadi Balagangadhara
10357	Gupta, Surendra Kumar ‡
10358	Khambete, Capt. Sudhirchandra Bhimrao
10359	John, Mampilly Chummar
10360	Vijayasundran, Konnanatt †
10361	Sharma, Babu Ram †
10362	Bhaskaran, Pathiyil
10363	Kalsar, Lt. Shesh Paul ‡
10364	Lokur, Mohan Narayan ‡
10365	Ganesh Pillay, C.
10366	Balakrishnamurti, Puliyadi Ramachandra
10367	Sinha, Sita Ram
10368	Logarajalu, Perumalchetty
10369	Satyanarayana, Kandukury
10370	Jog, Flg.-Off. Shrikrishna Dattatraya ‡
10371	Bhalla, Capt. Avinash
10372	Joshi, Raghunath Purushottam †
10373	Prakash, Gyan
10374	Satyanarayana Rao, Thumpudi
10375	Agarwal, Chunilal Girdharilal †
10376	Iyer, Dr. Krishna Subramania
10377	Rath, Harihar
10378	Gopalakrishnamurty, Mogali
10379	Ahuja, Capt. Devinder Singh
10380	Agarwal, Devi Das
10381	Gaitonde, Durga Pandurang
10382	Mohan, Ram
10383	Krishnaswamy Rao, Gopalarao
10384	Rana, Capt. Surinder Singh
10385	Rajagopala Rao, Patnayakuni †
10386	Singh, Capt. Harbhajan
10387	Singh, Capt. Rajendra Pal
10388	Khan, Mohamed Karimullah ‡

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‡ Transferred from Graduate

† Transferred from Student

ASSOCIATE MEMBERS (*contd.*)

No.	Name	No.	Name
10389	Iyengar, G. K. Channakeshava	10432	Rath, Kaliprasad
10390	Vaish, Shugan Chandra †	10433	Kellogg, Sohan Prakash
10391	Tuli, Capt. Krishan Kumar	10434	Rajan, Bangalore Hanumanthiah
10392	Sastry, Kalavakolanu Purnananda †	10435	Pedgaonkar, Vasant Laxmanrao
10393	Mehta, Indrajit Maganlal	10436	Hadap, Maj. Gopal Balkrishna
10394	Shelat, Rohitkumar Nanoobhai	10437	Sanyal, Satya Prasad
10395	Suryanarayanamurthy, Yerramilli ‡	10438	Puri, Flt.-Lt. Charanjit Singh
10396	Menon, Manavazhi Mohandas	10439	Varma, Capt. Som Dev
10397	Tewari, Lal Behari	10440	Lakshminarayanan, Capt. Venkatarama
10398	Sheorey, Lakshman Narayan	10441	Patel, Ramanlal Maganlal
10399	Srinivas, Bindiganavale Krishniengar ‡	10442	Palvankar, Yeshwant Kashinath
10400	Adiga, K. Srinivas	10443	Basur, Tripat Singh
10401	Nagabhushan, Capt. Yelur Dharmappa	10444	Narendra Nath, Capt.
10402	Gupta, Pramod Kumar	10445	Handa, Maj. Roshan Lal
10403	Singh, Capt. Amrik	10446	Gujar, Purushottam Vithaldas
10404	Tahiliani, Capt. Kundan Hariram	10447	Aggarwal, Surindar Kumar
10405	Hazarika, Rabindra Nath	10448	Gandhi, Madhukumar Bhagwandas
10406	Limaye, Shripad Keshav †	10449	Pathan, Abbaskhan Latifkhan
10407	Ramamurty, Mitthinti Prabhakara	10450	Kolwalkar, Shriram Shantaram
10408	Gopal, Capt. Pran Krishan ‡	10451	Thakurdesai, Balkrishna Shripad
10409	Suryanarayana, Narasipur Venkataram	10452	Sane, Sadashiv Gopal
10410	Yadava, Maj. Jai Dayal Singh	10453	Raheja, Gopal Lachmandas
10411	Parikh, Krishnakant Hiralal	10454	Modekurty, Venkata Prakasarao
10412	Dimri, Capt. Sachida Nand	10455	Soman, Madhav Gopal †
10413	Korah, Pallathucheril Varkkey	10456	Dhir, Flg.-Off. Rajinder Mohan
10414	Vidyarthi, Bhuwaneshwar Prasad	10457	Rai, Dhanpat †
10415	Narendra Singh, Capt.	10458	Mohanty, Anil Kumar
10416	Tyagi, Capt. Krishna Chandra	10459	Banavalkar, Kusumakar Vaman ‡
10417	Shah, Pralhad Voljidas	10460	Bhandari, Ramnath Chand
10418	Shah, Arvind Kantilal	10461	Raju, Kosuri Narasimha
10419	Akkalkotkar, Capt. Laxman Rangnath	10462	Desai, Pravin Rasiklal
10420	Ahluwalia, Maj. Jagjit Singh	10463	Patra, Gopinath
10421	Kotwal, Flg.-Off. Chaman Lal	10464	Panduranga Rao, Sanjivisubbarao ‡
10422	Sen, Chitta Ranjan	10465	Shende, Madhav Ganesh ‡
10423	Sen Gupta, Arun Kumar	10466	Vaish, Bhagwan Swarup †
10424	Sokhi, Kripal Singh	10467	Ramabhadran Nair, Kesavapillai
10425	Lall, Capt. Digby	10468	Narasimhamoorthy, Vadali
10426	Tawadey, Mukundrao Bapuji	10469	Arthur, Relton Peterson
10427	Joshi, Vishnu Dinkar †	10470	Narayan, Rameswami Lakshmi
10428	Venkatraman, Capt. Peruvemba Subramani	10471	Guruswamy, Shanmugavelayutham
10429	Sheth, Niranjan Chimubhai	10472	Narayana Rao, Sreemanta Vasudevarao ‡
10430	Mohan, Capt. Mehta Shivraj Krishan	10473	Dasgupta, Dr. Samarendra Mohan
10431	Patel, Suresh Narandas	10474	Tyagi, Paritosh Chandra ‡

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‡ Transferred from Graduate

† Transferred from Student

ASSOCIATE MEMBERS (*contd.*)

No.	Name
10475	Kandal, Capt. Muljit Singh
10476	Bhagwat, Madhukar Shankarrao
10477	Arya, Dr. Anand Swarup
10478	Kannan, Thakkolam Santhamarai
10479	Krishnan, Kurumbail Subramanier
10480	Sidhu, Harbhajan Singh
10481	Basu, Debidas
10482	Srivastava, Mahabir Prasad
10483	Gangadharan Nadar, Kochannadar †
10484	Mahanta, Jagat Chandra
10485	Dinker, Bekal Pattathan
10486	Ramachandran, Mannargoddi Srinivasan ‡
10487	Natesan, Subbiah
10488	Datta, Shubhendra Kumar
10489	Maitra, Sudhansu Bhusan
10490	Gupta, Nikhil Kumar
10491	Dey, Mahadev
10492	Krishnamurthy, Flg.-Off. Rajagopal
10493	Sen, Samir Kumar
10494	Krishnamurthy, Mayuram Rajagopalaiyer
10495	Prakash, Satya
10496	Kulkarni, Sheshagiri Venkatesh
10497	Mukerji, Maj. Din Bandhu
10498	Raha, Kanailal
10499	Baksi, Ranajit Kumar
10500	Banerjee, Saroj Kumar
10501	Ray, Sankar Prasad ‡
10502	Nanjundiah, Yellambalase Neelakantiya
10503	Sen, Gour Mohan
10504	Kotwal, Vijay Yashwant
10505	Randeria, Mukundchandra Nathalal
10506	Rajvanshy, Prem Swaroop
10507	Basu, Dilip Kumar
10508	Shrivastava, Umesh Kumar
10509	Mukundan, M. Gobindapillai
10510	Pillay, Lt. Parthasarathy Krishna
10511	Sharma, Brij Mohan
10512	Pal, Dhirendra Nath ‡
10513	Harish Chander ‡
10514	Chattopadhyay, Prosanto Kumar
10515	Ghosh, Somnath
10516	Bhat, Hosakere Subba
10517	Chatterjee, Som Nath
10518	Kundu, Satya Brata
10519	Hajra Chowdhury, Samir Kumar
10520	Subrahmanyam, Tadepalli Venkata
10521	Dave, Jashvantrai Ramshanker
10522	Chayamurthy, Kalale Suryanarayanarao
10523	Mehta, Shirish Gulabray
10524	Sridhara Murthy, Hirekerebally Srikakula
10525	Bose, Tarun Kumar
10526	Dalal, Madanmohan Chinubhai
10527	Reddy, Aulla Sankara
10528	Chakrapani Rao, Gadiyara
10529	Karakaraddi, Basappa Hanumappa
10530	Mane, Pandurangrao Nilkanthrao
10531	Rajarathnam, Kolapalam Venkataramiah
10532	Raghunath, Hiremagalur Lakshminarasimiengar
10533	Banerjee, Paritosh
10534	Khadilkar, Madhukar Ramchandra
10535	Ganapathi, Kodaganallur Krishnan
10536	Patel, Jamnadas Trikamlal
10537	Sivaramakrishnan, Sankaranarayana ‡
10538	Barua, Harendra Nath
10539	Sharma, Lt. Vasishth Deva
10540	Subbaramu, Kalale Suryanarayanarao
10541	Jandial, Sunderlal †
10542	Patel, Kanubhai Prabhudas ‡
10543	Harinder Singh, Capt.
10544	Dubasia, Nanjibhai Laxmanbhai
10545	Shah, Harishchandra Natvarlal
10546	Buch, Dhananjay Trambaklal
10547	Patel, Narottambhai Godaddas
10548	Madhvani, Popatlal Vallabhji
10549	Khular, Vijendra Lal
10550	Rao, Duvvur Satyanarayana
10551	Ahmed, Flt.-Lt. Aftab
10552	Desai, Surendra Bansilal
10553	Subramanyam, Raghunatha
10554	Bansal, Babulal Jhutharam
10555	Sarovthama Rao, Hooraguppe Narasingarao
10556	Iyengar, M. Sampath
10557	Patel, Maftubhai Jethabhai
10558	Shidhore, Haribhau Laxmanrao

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ASSOCIATE MEMBERS (*contd*)

No.	Name
10559	Derasari, Jamu Ranjit
10560	Dutt, Nihar Kusum
10561	Virdi, Capt. Sahib Singh
10562	Shah, Rasiklal Mohanlal
10563	Shorawal, Om Behari ‡
10564	Krishnanand Rao, Babe
10565	Ramachandra, Saklespur
10566	Parthasarathy, Minasandram Ramaswamiengar
10567	Jain, Gyan Chandra
10568	Patel, Vithalbhai Damodardas
10569	Vasudeva Rao, Turuvekere Lakshmiramaniah
10570	Shrivastava, Harcharan Lal †
10571	Singh, Karam Raj †
10572	Ghosh, Utpal Krishna †
10573	Guha, Piyus Kanti †
10574	Gupta, Kanwar Das ‡
10575	Surty, Noshir Kaikobad ‡
10576	Mukherjee, Devaprasad †
10577	Joshi, Chintamani Shankar
10578	Dutta Choudhury, Sisir Kumar
10579	Deshpande, Suresh Shankar
10580	Sarangi, Nabakishore
10581	Rath, Kambudhar
10582	Srinivasalu, Divela
10583	Satish Chandra
10584	Patnaik, Uriti Ramachandra Rao
10585	Barve, Narayan Sankar †
10586	Sethuraman, Capt. Koneripatti Ramaseshan
10587	Kondap, Digamber Martand
10588	Narayanan, Chidambara †
10589	Ramachandran, Madhavan
10590	Gupte, Surendra Dattatray
10591	Ahsan, Syed Abdullah
10592	Anand, Capt. Satya Pall
10593	Parankushan, Vrittamani Narayanaiyengar
10594	Aga, Minoo Ardeshir †
10595	Sandhu, Capt. Jagjit Singh
10596	Patni, Capt. Mohan Chandra
10597	Dasgupta, Biman
10598	Sethee, Capt. Premindra Singh
10599	Handa, Virender Kumar
10600	Sen Gupta, Sunil Kumar
10601	Lahiri, Syamal Kumar
10602	Sarma, Nandiraju Lakshmi Narasimha †
10603	Seth, Baldev Raj
10604	Nanavati, Sagunrai Dilsukhrai
10605	Bhattacharyya, Bibhuti Bhushan
10606	Sen, Jitendriya Nath
10607	Chakravarty, Shyamal Kumar
10608	Narasimhamurthy, Rudrapatna Nale
10609	Mukherjee, Subas
10610	Vishwakarma, Gangaprasad Damroolal ‡
10611	Nair, Kunnath Achuthan
10612	Bhandari, Manohar Mal ‡
10613	Ramanathan, Janakiraman
10614	Sivasubramoniam, Dhanukodi
10615	Chandrasekharan, Methil
10616	Kejriwal, Sitaram
10617	Kamath, Hattiangady Shrinivas
10618	Chaoji, Vijaykumar Haripant ‡
10619	Moudgal, Capt. Narasimha
10620	Saha, Sunil Gobinda
10621	Dalvi, Avinash Prabhakar
10622	Kinra, Om Prakash
10623	Ramamurthy, Trichinopoly Subrahmanyam
10624	Ghosh, Amitabha
10625	Raghavan, Sadasivan
10626	Mehta, Man Mohan Singh
10627	Bandyopadhyay, Sudhir Kumar
10628	Dalal, Shapur Jamshed
10629	Nagaich, Satyavan
10630	Sharma, Gopal Nidhi
10631	Subrahmanyam, Devarayasamudram Ramaiyer
10632	Narayanan, Mahalingaiyer ‡
10633	Rao, Prateep
10634	Krishnamurthy, Sonti Venkata Radha
10635	Das, Sitola Prasad
10636	Yogendra Singh
10637	Razack, Syed Abdur
10638	Bhat, Niddodi Vasudeva
10639	Deo, Chandrashekhar Vaman ‡

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ASSOCIATE MEMBERS (*contd.*)

No.	Name
10640	Tewari, Guru Datta ‡
10641	Aggarwal, Vasdev
10642	Ganapathi, Sankaraiyer
10643	Satapathy, Satchindananda
10644	Sharma, Har Bhagwan ‡
10645	Rao, Athuri Chakradhara
10646	Dubey, Madan Mohan
10647	Subbaratnam, Sankaraiyer
10648	Gour, Shashi Bhushan
10649	Saxena, Maj. Krishan Chander
10650	Bhandari, Banarsi Lal ‡
10651	Sasturkar, Kesorao Sridharrao
10652	Badari Narayan, Ponnathapur Srinivasamurthy
10653	Sastry, Sidlaghatta Narasimha Ramanarasimha
10654	Appukuttan Nair, Kesavamaur
10655	Krishnamoorthy, Kamatam
10656	Subbarayudu, Thallam
10657	Pillai, Karnam Vajravellu
10658	Selvarajan, Nagarathnam
10659	Mani, Samudram Venkatasubbaiya ‡
10660	Kapila, Capt. Rishi Kumar
10661	Subbarayudu, Chennupaty
10662	Khan, Mohammed Saleemulla
10663	Kumar, Capt. Jagdish
10664	Sengar, Govind Singh
10665	Khamesra, Manohar Singh
10666	Rohatgi, Arjun
10667	Sabapathy, A. Subramaniapillay
10668	Balbir Singh
10669	Krishnamurthy, Hanasoge Narayanarao
10670	Parikh, Vinodchandra Jayantilal
10671	Srivastava, Gauri Shanker
10672	Dholoo, Tehemton Fredoon
10673	Khan, Munir Gulab
10674	Gulatee, Sureshkumar Mohanlal
10675	Subba Rao, Mojnidar Lakshmanarao
10676	Singh, Arjun †
10677	Balakrishnan, Maj. Vataranyam
10678	Mahapatra, Amarendra Kumar
10679	Bhatia, Naraindas Hemandas ‡
10680	Deo, Dhirendra Narayan Singh
10681	Subudhi, Kotakota Trinath
10682	Ramanathan, Lt. Perinkulam Kanakasabapathi ‡
10683	Purushotham, M.
10684	Lall, Capt. Shyam Behari
10685	Sharma, Mokshagundam Subbarao Venkatesha
10686	Bhargava, Naresh Chandra
10687	Bawa, Kharati Lal †
10688	Thomas, Kurian
10689	Srinivasa Rao, Appu Ranganatha
10690	Kisan, Chokhey Lal
10691	Nambiar, T. P. Parameswaran
10692	Baldua, Shri Krishna ‡
10693	Darwin, Chelliah Etty
10694	Parmar, Phoolchand Vardichand
10695	Singanporia, Minocher Nanabhoy
10696	Rao, Kullaji Gopala Krishna
10697	Gurbachan Singh ‡
10698	Dave, Jagdish Premshanker
10699	Broota, Sat Prakash ‡
10700	Anantha, Rameswami
10701	Patel, Hasanali Ahmed
10702	Radhakrishnan, Subramanyiah
10703	Khullar, Madan Mohan Lal
10704	Misra, Nrushinha Charan
10705	Rama Rao, Manepally Narayanarao
10706	Menon, Vijai Kumar ‡
10707	Satyananda Rao, Thota
10708	Agrawal, Madan Mohan Chandra
10709	Wagh, Mohon Padmanabh
10710	Naidu, Malla Venkataswami
10711	Sankara Ayyar, Viswanathaayyar
10712	Bains, Capt. Santokh Singh
10713	Dutta, Sailendra Kumar
10714	Das, Gobinda Charan
10715	Santokh Singh
10716	Naik, Keshav Dattatraya
10717	Chorghade, Vishnu Govind ‡
10718	Kapur, Jia Lal
10719	Jha, Tara Kant
10720	Joshi, Vaman Ambadas
10721	Kar, Prasanta Kumar

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ASSOCIATE MEMBERS (contd.)

No.	Name
10722	Tripathi, Capt. Jagdish Prasad
10723	Narasimhamurty, Pedaprolu Lakshmi †
10724	Ilam Chand †
10725	Sreeramamurthy, Pinnamaneni ‡
10726	Thomas, Vadakkedathu Oommen †
10727	Bhatnagar, Maj. Parmatma Swarup †
10728	Intzar, Karter Singh ‡
10729	Gopinathan, Thonnangamath
10730	Subramaniam, Ganapathier
10731	Patel, Nawal Kishore
10732	Mookerjee, Capt. Santosh Gopal
10733	Rajan, Thangali Seshadriengar
10734	Joshi, Aravinda Vithal
10735	Venkateswara Rao, Kunchaparty
10736	Rao, Koka Venkata Laxmi Narayana
10737	Awasthi, Maj. Yogendra Shanker
10738	Jagannath, Narayanaswamy
10739	Krishnamachari, Srinivasaraghava Venkata
10740	Satyanarayana, Jakkula
10741	Vaidya, Shriram Vitthal
10742	Shanbhag, Murlidhar Subrao
10743	Datta, Capt. Deependra Nath
10744	Bhagwat, Madhukar Gopal
10745	Nath, Nallagula Pandari
10746	Jain, Sushil Kumar
10747	Malhotra, Jagmohan
10748	Garg, Sukhnandan Lal
10749	Rai, G. Raghunatha
10750	Ahmed Ali, L.
10751	Viraraghavan, Thiruvenkatachari
10752	Bhalla, Flt.-Lt. Kul Raj Singh
10753	Puri, Kapil Dev
10754	Mehta, Gheesulal Mohanlalji
10755	Prabhakar, Hiriasve Lakshmanaswamy
10756	Bhide, Manohar Balwant
10757	Moorthy, Ayyagari Satyanarayana
10758	Raju, Manthena China Venkata Rama
10759	Ramachandra Rao, Buddha
10760	Sastry, Trikutam Vishwanatha
10761	Subba Rao, Kondadasula Venkata
10762	Reddi, Kambam Lakshmana
10763	Soni, Hasmukhlal Vadilal
10764	Kameswara Rao, Mattay
10765	Anand, Capt. Rajender Nath
10766	Hajela, Maj. Dhaneshwar Prasad
10767	Jain, Khushwant Rai
10768	Khular, Maj. Yogendra Lal
10769	Rao, K. Shankar Narayan
10770	Jadhav, Gopichand Dhondiba
10771	Dugal, Harcharan Singh
10772	Kavathekar, Atmaram Vinayak
10773	Venkatraman, Subramanian
10774	Sundaram, Vengipalayam Palanivel
10775	Sivamani, Munangadu Natesa
10776	Kishore, Maj. Shiv Raj
10777	Dave, Jaydev Mohanlal
10778	Srinivasan, Vedartham Gopala †
10779	Pujji, Jitendra Singh ‡
10780	Bhattacharya, Chitta Ranjan ‡
10781	Viswanathan, Koduvayur Krishnaiyer ‡
10782	Prakash Chandra
10783	Chatterjee, Prabir
10784	Mulay, Jayant Malharrao
10785	Raman, Capt. Puduvayal Nityanandan Siva
10786	Nanjundayya, Hebbalalu Velpanur
10787	Govindan, Wuliyanellur Ramappa
10788	Thirunarayan, Kalkunte Ramanujaiyengar
10789	Radhakrishnan, Sellapillai
10790	Nazareth, Flt.-Lt. Stanley Joseph
10791	Venkatachalam, Yelambakam Chenthamaraikannan
10792	Sen, Bimal Kanti
10793	Luthra, Bhim Sain
10794	Modi, Vinodchandra Keshavlal
10795	Talib, Abdulhusein Abdeali
10796	Nayak, Krishnakant Chandulal
10797	Sekhon, Capt. Gurdip Singh
10798	Krishna Murthy, Mysore Ramarao
10799	Shivaswamy, Hosakote Nanjundasastry
10800	Srinivasa Murthy, Gorur Rameswamiengar
10801	Ganeshmurthi, Chingleput Manickam
10802	Jog, Narayan Mahadeo
10803	Murthy, Kolar Ramakrishnaiah Sreenivasa
10804	Dave, Capt. Vinaya Kumar
10805	Viswanathan, P. Narayanaswamiyer
10806	Kapoor, Maj. Bansi Lal

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ASSOCIATE MEMBERS (*contd.*)

No.	Name
10807	Gurumurthy, Gundurao
10808	Thanasingh, Gnaniah Timothy Azariah
10809	Kandhal, Prithvi Singh
10810	Joshi, Capt. Yashvant Vasudeo
10811	Kukadia, Bhaktiprasad Purushottamdas
10812	Bhati, Ranveer Singh
10813	Chacko, Capt. Roy Thomas
10814	Sidhu, Sqn.-Ldr. Sukhdeo Singh
10815	Desai, Arvandrai Balvantrai
10816	Patel, Keshavlal Sendhabhai
10817	Krishan Lal, Capt.
10818	Bhatt, Mahipat Manilal
10819	Jacob, P. Thomas
10820	Rawther, H. P. Mohammed
10821	Samath, K. A.
10822	Dhodapkar, Capt. Hemantkumar Chintamani
10823	Murugan, Flt.-Lt. Subbiah
10824	Subramanian, Alampallam Venkatramaiyer
10825	Chakko, Puthenpurackal Chakko
10826	Lal, Girdhari
10827	Mittal, Capt. Ravindra Kumar
10828	Mehta, Ramchandra Nathalal
10829	Khadilkar, Gopal Shankar ‡
10830	Dattatreya, Capt. Hari Mohan
10831	Nagaraj, Gadasalli Subramanya
10832	Singh, Capt. Inderjit
10833	Goyal, Capt. Hridaya Mohan
10834	Kalra, Amrit Lal
10835	Abdul Aziz, Kottackal Kasimrowther
10836	Nilakanta Iyer, Venkitachalamiyer
10837	Khan, Capt. M. Ahmad
10838	Kumaraswamy, Thiruvengadam
10839	Pillay, Nilakantapillay Sivathanu
10840	Singh, Flt.-Lt. Gurbachan
10841	Ramachandran, Maj. Yegnaswami
10842	Roy, Sailendra Narayan
10843	Hanumanthachar, Garani
10844	Rao, Ganguli Mohan
10845	Shenoy, Kasaragod Narasimha
10846	Naidu, Ramamandiram Bhakthavatsalu Dasaratharam
10847	Jain, Capt. Sudarshan Kumar
10848	Navagire, Dhondiram Krishna
10849	Shah, Mukundrai Harjivandas
10850	Shah, Niranjan Natwarlal
10851	Datta, Capt. Ashoke
10852	Deshmukh, Madhao Bajirao
10853	Subbiah, Mannar Ramaswamy
10854	Oommen, Adangaprathu Oommen
10855	Shah, Natavarlal Mohanlal
10856	Pai, Jeppu Ekanath
10857	Raghavan, Capt. Rajagopal
10858	Desai, Rahimbhai Mahammedbhai
10859	Shah, Vinodchandra Dwarkadas
10860	Bhatia, Capt. Harish
10861	Prakash, Dr. Shamsher
10862	Kapur, Sqn.-Ldr. Dalbir Kumar
10863	Kissondas, Ramdas ‡
10864	Sathyakaman, Aringcunram Venkataraman ‡
10865	Gupta, Shyam Lal ‡
10866	Balaraman, Raman
10867	Veeraraju, Pitchika
10868	Sreedharan Pillai, P. Narayanapillai
10869	Ramamurthy, Jambunathan
10870	Bhagat, Brij Raj
10871	Tamizuddin, A. G.
10872	Menon, Manakot Unni Krishna ‡
10873	Swaminathan, T. K.
10874	Madan Mohan Roy, Adyar Vilvaroy
10875	Jain, Gun Bhushan Kumar ‡
10876	Modi, Pravinchandra Vitthaldas
10877	Prabhakara Rao, V. Sankaranarayanarao
10878	Syed Razzaque Ahmed
10879	Sapkal, Digant Shridharrao
10880	Das, Sukumar Chandra
10881	Gupta, Prem Prakash
10882	Dogra, Capt. Gautam Kumar
10883	Rajagopal, T. R.
10884	Dhar, Capt. Siddartha
10885	Sahni, Capt. Diwan Siri Ram
10886	Pandit, Capt. Bhartruhari Trimbak
10887	De, Renupada
10888	Sasan, Swaran Singh
10889	Mehta, Ganga Vishan
10890	Chauhan, Devendra Singh
10891	Iyengar, Sankighatta Krishnaiyengar Sreenivasa

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ASSOCIATE MEMBERS (*contd*)

No.	Name
10892	Nagabhushana Rao, Mahendrakar
10893	Kishen, Karumuri
10894	Sachidanand Swamy, Pulpa
10895	Mukhopadhyay, Asish Kumar
10896	Ram Kishan Rao, Vuppala
10897	Mahamood Ali, Muhammed
10898	Sen, Narendra Nath
10899	Venkateswara Rao, Chityala
10900	Narsingh, Mohansingh
10901	Ramchandra Rao, Thadiparthi
10902	Satyanarayana Rao, Aripirala Venkata
10903	Gopal Kishan Rao, Oddiraj
10904	Soans, Flt.-Lt. Noel Joseph
10905	Narayana, G. Rangaswamyiyengar
10906	Pathak, Krishna Kumar
10907	Das, Janardan Prasad
10908	Baliga, Baba Padmanabha
10909	Thakker, Laljibhai Kuberdas
10910	Sarkar, Jyotirmay
10911	Mitra, Chinmay Kumar
10912	Jhaveri, Babubhai Chimanlal
10913	Dani, Narayan Shripad
10914	Prusty, Raj Kishore
10915	Agarwal, Plt.-Off. Ram Narain
10916	Bhattacharyya, Dr. Hari Pada
10917	Ganguli, Ajit Kumar
10918	Rathi, Prem Narayan
10919	Ganesh Misra
10920	Majumdar, Suhas Chandra
10921	Biswas, Sanat Kumar
10922	Sambasiva Rao, Potineni
10923	Singhal, Ram Chandra
10924	Mukherjee, Ranjit Kumar
10925	Thyaramma, Hiriyur Siddamallappa
10926	Bagayat Patil, Shankar Ganesh
10927	Sharma, Sachindra Nath
10928	Dark, Victor Marshall
10929	Bhargava, Harish Chandra
10930	Ramachandra Murty, Bulusu Sree
10931	Pani, Ramesh Chandra
10932	Sen, Keshab Chandra
10933	Rau, Capt. Valluri Venugopal
10934	Pundir, Kashi Ram
10935	Subrahmanya Sastry, Madury Venkata
10936	Tuteja, Santokh Singh
10937	Pillai, Karnam Sivalinga
10938	Mohanty, Bipin Behari
10939	Sharma, Vishnu Dat
10940	Banerji, Raghu Nath
10941	Subbanna, Rudrapatna
10942	Venkataiah, Ravi Pedda
10943	Sen, Sudhi Ranjan
10944	Mukherjee, Dines Ranjan
10945	Bhatia, Capt. Brij Kumar
10946	Kamalakumar, Pothapragada
10947	Sinha, Fg.-Off. Vichar Sagar
10948	Ramanathan, Sundaram
10949	Maheshwari, Laxmi Nath
10950	Nanda, Santosh Kumar
10951	Maji, Muralidhar
10952	Nair, Narayan Ramchandran
10953	Bhatia, Maj. Sohan Singh
10954	Sastry, Chandrashekharasastry Sitharama
10955	Datta, Subir Kumar
10956	Mukherjee, Benoy Charan
10957	Rajvanshi, Bhupendra Singh
10958	Apte, Vishnu Purushottam
10959	Michael, Louis Jospeh
10960	Zaveri, Pravinchandra Manchhubhai
10961	Rao, Draksharapu Nagabhushana
10962	Ahuja, Capt. Satish Chander
10963	Prakasa Rao, Bethina Surya
10964	Adinarayana Chowdary, Saladi
10965	Sudarsana Rao, Cherla
10966	Srinivasa Rao, Thota
10967	Rawat, Dwarka Prasad
10968	Phatak, Prabhakar Ramchandra
10969	Mukundan Achan, Paliath
10970	Sathya Subramanya, Ponnathapura Narayanarao
10971	Ghosh, Karunamoy
10972	Ghosh, Malay Kumar
10973	Sarkar, Mrinal Kanti
10974	Shankar, Suryanarayanasetti
10975	Padmanabhan, Kalamangalam Venkatarao
10976	Shrivastava, Capt. Kailash Kumar
10977	Joshi, Shyam Lal
10978	Raphael, Olapruth Chummar
10979	Sharma, Girraj Saran
10980	Das, Rama Nath

ASSOCIATE MEMBERS (*contd.*)

No.	Name
10981	Khanduri, Capt. Bhuwan Chandra
10982	Ramanathan, Flt.-Lt. Vaidyanathan
10983	Billimoria, Shantilal Lallubhai
10984	Kamdar, Vipinchandra
10985	Dhariwal, Sampatmal
10986	Agrawal, Goverdhanlal
10987	Shrivastava, Laxmi Prasad
10988	Subba Rao, Seshagirirao
10989	Sahu, Prayag Prasad
10990	Gupta, Harish Chandra
10991	Palnitkar, Vithal Gopinath
10992	Rangachari, Rajagopalan
10993	Krishnamoorthy, Narayanaswamy
10994	Nath, Bhabakanta
10995	Basivi Reddi, Arumalla
10996	Sundaram, Narayanaswamy
10997	Das Gupta, Arun Kumar
10998	Paul, Gopeswar
10999	Kundu, Arun Kumar
11000	Dey, Biswanath
11001	Maheshwary, Achyut Prakash
11002	Bhatt, Rewa Prasad
11003	Swaroop, Shanti
11004	Shrivastava, Prem Kumar
11005	Krishna, Flt.-Lt. Indrakanty Gopala
11006	Bhalla, Flt.-Lt. Inder Jit
11007	Mazumdar, Maj. Sukhamoy
11008	Choudhury, Sukumar
11009	Roy Choudhury, Flt.-Lt. Shib Nath
11010	Patnaik, Birendra Chandra
11011	Jingal, Phool Chand
11012	Singh, Hanuman
11013	Bamezai, Capt. Ashok Kumar
11014	Chanda, Nirmal Chandra
11015	Malakonda Reddy, Vundela
11016	Jagannadha Rao, Koka
11017	Tandan, Binod Kumar
11018	Bhattacharya, Anileswar
11019	Pandey, Maj. Rishi Kumar
11020	Bhaskar, Flt.-Lt. Jagdish Rai
11021	Sharma, Ramakant
11022	Rangaiah, Medikonda
11023	Dharaskar, Sharadchandra Sadashiv
11024	Rahman, M. Sabibur
11025	Chatterjee, Paritosh
11026	Gad, Vijay Motiram
11027	Patil, Prabhakar Harishchandra
11028	Balasubramanian, Vaidyanatha
11029	Singh, Capt. Ranvir
11030	Batra, Krishan Lal
11031	Venkata Raman, Lt. Krishnamurthy ‡
11032	Cheema, Iqbal Singh
11033	Ranganathan, Narunamangalam Ramabhadran
11034	Shah, Arunkumar Nandlal
11035	Ganguly, Rasbihari
11036	Thampi, Velupillai Nirmalan
11037	Seshagiri Rao, Punnamraju
11038	Satyan, Bindiganavale
11039	Nayak, Kumbla Shantharama
11040	Mallik, Dhiroj Kumar
11041	Menon, Moothedath Govindan Kutty
11042	Chittaranjan, Flt.-Lt. Nivarthi
11043	Patel, Shivabhai Bababhai
11044	Padhi, Upendra Mohan
11045	Basu, Apurba Kumar
11046	Roy, Biman Kanti
11047	Timothy, Capt. George
11048	Das Baksi, Nripendra Mohan
11049	Shah, Sureshchandra Mohanlal
11050	Srinivasan, Rajagopalan †
11051	Bandyopadhyay, Sanat Kumar
11052	Palayya, Dr. Alturi
11053	Sharma, Jaidev
11054	Misra, Madan Mohan Lal †
11055	Ranganathan, Srinivasachari
11056	Ram Mohan, Aiyanadar
11057	Dhanavelu, Subramanyam
11058	Menon, M. R. Balakrishna
11059	Narayan Rao, Nidadavolu Nara
11060	Nayak, Irvathur Vasudeva
11061	Muthu Krishnan, Muthuswamy
11062	Ramakrishnan, Kunnathmadhathil Neelakantaiyer †
11063	Mukhopadhyaya, Flt.-Lt. Amal Kumar
11064	Thussu, Omkar Nath ‡

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‡ Transferred from Graduate
Transferred from Student

ASSOCIATE MEMBERS (*contd.*)

No.	Name
11065	Arora, Vidyasagar Lekhraj ‡
11066	Dutt, Ashim Kumar ‡
11067	Rai, Kailash Roop
11068	Taneja, Capt. Jaswant Rai ‡
11069	Bari, Bimalananda ‡
11070	Singhji, Om Nath
11071	Lodh, Bhudeb Chandra
11072	Ramamurthy, K. Narayanarao
11073	Sarma, Baladev
11074	Parikh, Piyushkant Venilal
11075	Choudhary, Ram Brijbhawan
11076	Sarkar, Asim Kumar
11077	Sawtell, John Ellis
11078	Lal, Hari Bansh
11079	Zaveri, Amichand Khimchand
11080	Ganu, Ganesh Yeshwant
11081	Shah, Mahendrakumar Ratilal
11082	Goel, Capt. Indu Bhushan
11083	Gosh, Bholanath
11084	Veerabhadrappa, Alaghattada
11085	Shankar, S. Rajamani
11086	Kapoor, Sudarshan Lal
11087	Shah, Bhupendra Chimanlal
11088	Khadilkar, Narayan Chintaman ‡
11089	Roy, Sachindra Mohon
11090	Patel, Chandoobhai Kashibhai ‡
11091	Krishnaraja, Tommundrum Balasubramania
11092	Iyengar, Mysore Srinivasa Narayan
11093	Shukla, Kalp Nath
11094	Maitra, Maj. Arup Kumar
11095	Kulkarni, Shriniwas Rangnath
11096	Dadina, Kersi Nanabhoy
11097	Fernandes, Augustine Victor Joseph
11098	Goel, Kailash Chandra
11099	Sawant, Shivaji Ganesh
11100	Sahu, Baidya Nath
11101	Bhodasgaonkar, Ramprasad Vyankatesh
11102	Ramaswamy, J. N.
11103	Prabhu, Shiva Ganesha
11104	Krishna Murthy, Hoskote Srikantan
11105	Seshadri, Bindignavile Krishnaswamy
11106	Banerjee, Sunil Kumar
11107	Dayal, Binoy Kumar
11108	Agarwal, Krishnachandra Bisheshwardayal
11109	Kambal, Yash Paul
11110	Gnanasambandam, Arunachalampillai
11111	Potdar, Jayant Dattatraya
11112	Chatterjee, Shyamapada
11113	Dass, Ganadeb†
11114	Dandekar, Dattatraya Maheswar †
11115	Panda, Bipin Behari‡
11116	Gupta, Jagdish Chandra
11117	Sharma, Jagdish Prasad‡
11118	Chatterjee, Prokash Chandra ‡
11119	Bhattacharyya, Parimal Kumar
11120	Rana, Gour Chandra
11121	Chakraborty, Satya Ranjan †
11122	Chakravarty, Ashok‡
11123	Aggarwala, Maj. Rajendra Kumar
11124	Gupta, Mahesh Chandra
11125	Krishnamachar, Tadimari Srinivasachar
11126	Kardile, Jayant Narayan
11127	Bhattacharya, Dr. Santi Gopal
11128	Mukherjee, Sanat Kumar
11129	Tongaonkar, Arvind Sadashiv
11130	Silva, Francis Xavier
11131	Shivaprasad, Doddabasappa †
11132	Chattopadhyaya, Satya Brata ‡
11133	Ram, Valiveti Satya Ganapathy
11134	Batra, Maharaj Kishan
11135	Sardalia, Yogendra Singh ‡
11136	Ranadive, Vijaykumar Jagannath
11137	Madan, Om Prakash ‡
11138	Narasimha Rao, Kamisetty
11139	Sehra, Parmanand Tejbhan
11140	Gupta, Shri Niwas †
11141	Vaishnavi, Girdhari Lal ‡
11142	Thomas, Alfred Abraham
11143	Thomas Eapen
11144	Pakriswamy, Ramaswamy
11145	Varma, Dwarka Prasad
11146	Jayaram, Tiruvangad Govindaswamy
11147	Hebbar, Kattingeri Madhava
11148	Patel, Maganbhai Zaverbhai

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‡ Transferred from Graduate

† Transferred from Student

ASSOCIATE MEMBERS (*contd.*)

No.	Name
11149	Krishna Moorty, Pulipaka Venkata Rama
11150	Roy, Sudhir Chandra
11151	Dhavalikar, Dattatray Ganesh
11152	Tolani, Ranjit Motoomal
11153	Mehta, Kiritkumar Rasiklal
11154	Mahodaya, Madan Mohan ‡
11155	Ali, Syed Gowher ‡
11156	Chellappa, Raghavachari ‡
11157	Shrivastav, Ramesh
11158	Madhavan, Gopalan ‡
11159	Varma, Ramesh Chandra ‡
11160	Shaban Mir, Mohmad
11161	Saproo, Arjannath
11162	Rajesh Bahadur, Capt.
11163	Karir, Flt.-Lt. Brij Mohan Prakash
11164	Hardyal Singh
11165	Ganesh Chandra
11166	Kesavan, T. Theagarajapillai
11167	Sharma, Mahendra Narain
11168	Srinivasamurthy, A. Ramarao
11169	Bishnoi, Flt.-Lt. Narendra Singh
11170	Sati, Maj. Khyali Ram
11171	Nag, Gopal Lal
11172	Singhal, Agam Prakash
11173	Ahmad Ali, Mohammed
11174	Malhotra, Maj. Raghbir Kumar
11175	Badhwar, Kuldeep Singh
11176	Barretto, Capt. Christopher Anthony
11177	Gian Sagar, Capt.
11178	Chhabra, Capt. Inder Mohan
11179	Rameswamy, Paranji Rangaswamy
11180	Narasimhan, Fg.-Off. Bharthur Srinivasamurthy
11181	Madhava, Madhugiri Narasimhaiya
11182	Doraiswami, Kandaswami
11183	Venkataraman, S.
11184	Borah, Sarbananda
11185	Nanjunda Swamy, Hosakere Kapinipathi
11186	Chandrasekaran, Nungambakkam Jambulingam ‡
11187	Krishnamurthi, Vasudevan
11188	Ramnadham, Valsetty
11189	Bhaskara Rao, Fg.-Off. Mantripragada
11190	Nabar, Ratnakar Mangesh
11191	Reddy, Kalahastri Rama Chandra ‡
11192	Sukumaran, Gopalannair †
11193	Chaudhri, Lajpat Rai
11194	Mukhopadhyay, Kamal Kumar
11195	Chatterjee, Deb Kumar
11196	Viswanath, Lt. Chandrasekariah Krishnarao ‡
11197	Ghosh, Tarapada
11198	Raja Singh, Rajamani I.
11199	Ray, Debabrata
11200	Zaidi, Lt. Syed Ali Akhtar
11201	Paty, Pranabandhu ‡
11202	Kaul, Radha Krishan †
11203	Srinivasa Iyer, Venkatasubbaiyer
11204	Ayrton, Sammy Shavux
11205	Krishnamoorthy, Vallanore
11206	Kulshrestha, Shachindra Kumar ‡
11207	Sanikop, Subhashachandra Basavanneppa
11208	Parikh, Bipinchandra Savailal ‡
11209	Patel, Niranjanbhai Ambalal ‡
11210	Chaudhuri, Sumiti Kumar ‡
11211	Bhattacharyya, Chira Ranjan
11212	Thomas, Ambrose Bramwell
11213	Chandra, Jagdish
11214	Bhavanarayanan, Thodur Madapusi
11215	Mukherjee, Subir Kumar
11216	Ramasubramony, Hariharaiyer
11217	Bhargava, Rajendra Nath
11218	Sovennah, K. Motha
11219	Rai Kartar Singh ‡

GRADUATES

No.	Name	No.	Name
1515	Jalaluddin	1518	Kamalapurkar, Dwarakanath Balkrishna
1516	Daud, Taher Bhai	1519	Ahmad, Qazi Ashfaq
1517	Datar, Sudhir Vasant	1520	Lal, Hridaya Narain

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‡ Transferred from Graduate

† Transferred from Student

GRADUATES (*contd.*)

No.	Name	No.	Name
1521	Subramanian, T. Krishnamoorthy	1565	Singh, Padma Charan †
1522	Krishnamurthy, Rajagopalan †	1566	Nagaraja, Mugur Krishnamurthy †
1523	Thomare, Mrugendra Madhaorao	1567	Ray, Shushanta Kumar
1524	Achuthan, M.	1568	Mahajan, Sudhakar Gajanan
1525	Patel, Jehangir Phiroze	1569	Bahulkar, Martand Balavantrao
1526	Jauhar, Satish Chandra	1570	Maini, Satpal Singh †
1527	Guha, Mukunda Bhusan †	1571	Bhurchandi, Madhaw Mahadeo
1528	Shah, Nimai Chandra †	1572	Damle, Shrikant Bhargav
1529	Yadav, Chhail Chandra †	1573	Sandhu, Rajinder Singh †
1530	Rao, Janagam Atcheswar †	1574	Sabu, Bhagwan Das †
1531	Pitke, Vijay Laxman †	1575	Ramamoorty, Mylavarapu
1532	Ravindranath, Kunnath	1576	Hans, Ram Lal †
1533	Gupta, Ravindra Kumar †	1577	Damania, Minocheher Behramji
1534	Mitra, Ashit Kumar	1578	Ganguli, Sushanta Kumar
1535	Agarwal, Raj Kishore	1579	Seshadri, Chittur Narayanaswamy
1536	Sadasivan, Kandaswamy	1580	Jerajani, Vinod Navalbhai
1537	Tandon, Rajendra Kumar	1581	Sen Gupta, Digendra Kumar †
1538	Khadilkar, Narayan Chintaman	1582	Chakrabarti, Debi Das †
1539	Patel, Harishchandra Chandulal	1583	Murlidhar, Tirumakudlu Rameswamy
1540	Pandey, Ishwar Sharan †	1584	Shivaswamy, M. R. †
1541	Venugopal, Govindan †	1585	Mukherji, Biswanath †
1542	Gathwala, Balbir Singh †	1586	Ajwani, Atu Ramchand †
1543	Chhabra, Jagdish Chander †	1587	Shah, Janaklal Navnitlal
1544	Patwardhan, Wasudeo Ramchandra †	1588	Mohan Singh †
1545	Patel, Sumant Jethabhai	1589	Jose, Puthusseril Ittoop
1546	Jain, Tek Chand †	1590	Unnikrishnan, Manhapra
1547	Srinivasan, Kodaganallor Rameswami	1591	Bhargava, Radhey Shyam
1548	Prabhakar, Narne †	1592	Ramanujam, Ranganathan †
1549	Gangayacharyulu, Potla †	1593	Chugh, Aya Ram †
1550	Sinha, T. M. Satchidananda †	1594	Roy, Bimal Chandra †
1551	Chokshi, Rashmikant Kanaiyalal †	1595	Bose, Rathindra Nath
1552	Srivatsa, Srirangapatam Garuda †	1596	Datta, Jitender Kumar
1553	Limaye, Yashavant Atmaram †	1597	Garje, Vasant Santaram
1554	Kumar, Devendra	1598	Vema Reddy, Challa
1555	Sadanandan, Nadipuram Desikachar	1599	Manocha, Satya Pal †
1556	Mariwala, Kishore Vallabhdas	1600	Thomas, Anthony †
1557	Wig, Harbans Singh †	1601	Chattopadhyay, Sibabrata †
1558	Krishnamoorthy, Subramaniam †	1602	Venkata Shama Rao, M. Gopalarao †
1559	Venkatesh, Rajaratnam	1603	Ram Reddy, Gaereddy
1560	Baxi, S/Lt. Jagdish Janardan	1604	Sitaraman, Rajaram
1561	Rajarathnam, Lagisetty Venkataseshaiah	1605	Rajagopalan, Kidambi Ramanujachari
1562	Dakshina Murthy, Somayajula	1606	Suryanarayanan, Natarajan
1563	Shrivastava, Lakshmi Lal	1607	Basak, Shyamal Ranjan †
1564	Joshi, Manohar Kashinath	1608	Krishnamurthy, Ramamritam

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† Transferred from Student

GRADUATES (*contd.*)

No.	Name
1609	Jain, Kranti Kumar
1610	Shanmugam, Chokalingam †
1611	Natarajan, Tiruchengode Narasimha †
1612	Viswanath, Kondapi
1613	Varghese, Jacob †
1614	Sitha Rama Rao, Yallapragada
1615	Kohli, Lt. Trilok Kumar
1616	Deodhar, Vasant Ganesh
1617	Sharma, Jagat Narayan
1618	Venkatramani, Narasimhan
1619	Abraham, P. Mathew †
1620	Seshagiri Rao, Gandikota †
1621	Shah, Anil Shantilal
1622	Vasudevan, Palleth †
1623	Sreedharan Nair, Flt.-Cdt. Gopalapillai †
1624	Saini, Kundan Singh
1625	Gangwal, Kamalkumar Hiralal
1626	Narasimha Rao, Yantrapragada †
1627	Ramadorai, Koratti Subramaniam
1628	Gupta, Mahesh Chandra †
1629	Krishna Rao, Potlapalli †
1630	Sundaresa Rao, K.
1631	Gupta, Krishnabrata †
1632	Krishnamurthy, Purushothama
1633	Jabbi, Jaspal Singh
1634	Rathnakaran Nair, Kodoth Padinhareveetil
1635	Gulati, Kailash Chandra †
1636	Bisht, Pranvir Singh †
1637	Kawatra, Harmohansingh Amarnath
1638	Jhamb, Naresh Kumar
1639	Mishra, Durga Dutta †
1640	Kumar, Rajendra
1641	Gupta, Dinesh Kumar
1642	Cooper, Jamshed Rustom †
1643	Katre, Aravind †
1644	Gudi, Plt.-Off. Panduranga Vadirajacharya †
1645	Goyal, Chandra Mohan †
1646	Raghavan, Chellath †
1647	Krishna, Pasumarty Sri
1648	Kumar, Udiaver Somesh Mohan
1649	Das, Nihar Ranjan
1650	Jain, Ramesh Kumar
1651	Ray, Susanta Kumar
1652	Sen, Indrajit
1653	Mukhopadhyay, Baridbaran
1654	Raghava Reddi, Gorripati
1655	Chandrasekharan, Sundaram
1656	Kadam, Kishor Uttamrao
1657	Sharma, Banwari Lal
1658	Sharma, Sub.-Lt. Ajay Kumar
1659	Rana, Sub.-Lt. Ram Kishan
1660	Sharma, Vijai Kumar
1661	Mehta, Subhash
1662	Sinha, Pandaya Devendra Narayan
1663	Patel, Ashok Jayantbhai
1664	Sundaram, Subramanian
1665	Ojha, Veda Prakash
1666	Raghu Ram, Sundararajaiyengar †
1667	Reddy, Venkat Sudarshan †
1668	Sriramamurty, Chunduri †
1669	Lakshminarasimham, Dhurbhakula †
1670	Sitaraman, Mahadevaiyer †
1671	Moorthy, Munuswamy Govindarajulu Sathyanarayana †
1672	Goel, Yash Paul †
1673	Ebenezer, Cpl. Joseph Dass †
1674	Subbarayachary, Madanambedu †
1675	Madhusudhana Rao, Katamreni †
1676	Banerjee, Debaprasad †
1677	Balasubramanian, A. Rajagopalan †
1678	Bhagwat, Yashwant Krishnaji †
1679	Kulkarni, Vasant Hanamantarao †
1680	Bindra, Rajinder Singh †
1681	Chaudhari, Madhukar Ramchandra †
1682	Raghava Rao, Mandava †
1683	Guha, Nirmal Kanti †
1684	Mehta, Chandra Singh
1685	Nivarti, Dattatreya Ramappa
1686	Rajagopal, Venkateswaran
1687	Manna, Kartik Chandra †
1688	Kutty, Aniyath Raman †
1689	Bhanja, Sitangshu Kumar †
1690	Bhattacharya, Alokemay
1691	Padmanabham, Cherukuri

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† Transferred from Student

EMPLOYMENT SERVICE

This service is intended for the benefit of members of the Institution and for the Government, industrial and other organizations employing engineers. It is hoped that the employers will make full use of this service to obtain their requirement.

A small charge of Rs. 5 per insertion will be made to members for notices appearing in the 'Situations Wanted' column.

In the 'Situations Vacant' column a charge of Rs. 2 per line will be made.

Replies to advertisements should be addressed to Employment Service, The Institution of Engineers (India), P. O. Box No. 669, Calcutta 20, except where otherwise stated.

SITUATIONS VACANT

REQUIRED immediately experienced engineers for the Construction Division of Messrs. Arvind Brothers Private Limited, 4 Saklat Place, Calcutta 13.

1. Chief Design Engineer (Civil)

Experienced in the design and construction of bridges, major dams, etc. Gentlemen having experience in this specialized job and able to take responsibility of the work as Chief may please apply if prepared to join in short notice. Normally, we would prefer gentlemen within 45 years of age but this relaxable in most deserving cases. Preference will be given to one who has worked in similar capacity in world famous construction.

2. Chief Engineer (Civil)
3. Superintending Engineer (Civil)
4. Executive Engineer (Civil)
5. Assistant Engineer (Civil)

Gentlemen experienced in construction work specially of roads, earthwork, etc., may please apply with details of qualifications, experience, salary expected, etc.

SITUATIONS WANTED

YOUNG DIPLOMA HOLDER in Civil Engineering with three years experience in supervision of road and building construction and also R.C.C. work, age 25, seeks suitable post. (Office ref. E. S. 125)

YOUNG MECHANICAL ENGINEER, age 27 years, holds Higher National Certificate in Mechanica Engineering from London and have a total of over 7 years practical experience, of which 5½ years were spent in the U.K. This includes 3 years in the Drawing Office of a world reputed Boiler Engineering concern in the U.K. as Senior Designer Draughtsman. Seeks suitable position anywhere in India at a minimum salary of Rs. 500 per month. (Office ref. 126)

Form 362

THE INSTITUTION OF ENGINEERS (INDIA)
8 Gokhale Road, Calcutta 20
November 1963 Examinations

General information and instructions to candidates

(Approved by the Examinations Committee, 51st Meeting, Resolution 21, 30th December, 1958)

(Revised by the Examinations Committee, 57th Meeting, Resolution 19, 27th-29th June, 1961 ; and 58th Meeting, Resolution 10, 13th and 14th October, 1961.

(1) The next Studentship and Associate Membership (Sections A and B) Examinations will be held from Monday, November 4, 1963 to Monday, November 11, 1963, both days inclusive. The application forms for the Associate Membership (Sections A and B) Examination and the programme of examinations are attached to this *Bulletin*.

(2) **All applications accompanied by examination fees for admission to the November 1963 examinations should reach the Head Office before 4 p.m. on Monday, September 16, 1963.** Examination fees once paid are neither refundable nor transferable to a subsequent examination or to any other account. Receipt of examination forms will not be acknowledged by the Head Office, unless accompanied by a self-addressed post-card.

(3) **Examination fees should be preferably deposited at the State Bank of India in the candidates' locality. Attention of the candidates is specially drawn to item 4 in Form 304 (rev. 8) and item 5 in Form 305 (rev. 7) in this regard. The instructions for making such payment are given in card A (attached herewith) and on its reverse. Other modes of payment may be used only if this is not possible. Payment of examination fees by cheque will not be accepted.**

(4) No application for a change of examination centre will be entertained after 4 p.m. on Monday, September 16, 1963.

(5) Students who are in arrears of subscription will not be admitted to the examinations.

(6) **The Institution reserves the right to reject incomplete or illegible applications without any reference to the candidate.**

(7) No Student will be permitted to appear in the Section B examination unless he has fully passed the Section A examination or secured exemption therefrom. A candidate for the Section B examination should therefore mention the year in which he passed the Section A examination.

(8) Students appearing for the Section B examination under the revised rules 11.2.1 to 11.2.9 of the rules of examinations (see 'Rules and Syllabuses of Studentship and Associate Membership Examinations') should clearly state in the application form the name of the Local Centre to which they are attached.

(9) A candidate who has already passed the Section A and B examinations or is exempted therefrom will be permitted to appear in any paper or papers of Section A and/or Section B on payment of an examination fee of Rs. 30.00 per paper. The details of passing the Section A and B examinations or of exemption therefrom should be clearly stated in the examination form, with the grade of membership.

(10) The paper in 'Engineering Drawing II' is of 5½ hours' duration, with a half-hour recess between. Candidates will not, however, be permitted to leave the examination hall.

(11) Section B candidates should specially note to write down on the cover of their answer-books of the paper in 'Engineering Drawing II' the names of their particular sections, *viz.*, structural steelwork or reinforced concrete or machines or electrical or chemical plant.

(12) **Candidates are not permitted to use handbook(s) for the paper in 'Engineering Drawing II'. They may however use steel tables of the Dorman-Long type.**

(13) Candidates detected using unfair means in the examination hall will be expelled from the Institution and will not be readmitted to the Institution at any future time.

(14) Candidates reappearing in subject(s) in which they have already secured exemption(s), will have their paper(s) cancelled. The previous exemption(s) will stand.

(15) It is sometimes found that candidates do not enter their Studentship Number/Studentship Application Reference Number, Roll Number, or other necessary particulars on the answer-books. Such answer-books will be rejected and no attempt will be made to locate the candidates. Candidates should therefore take particular care to write down these particulars on the answer-books correctly.

(16) **The results of the November 1963 examinations will be declared before the last day of February 1964.**

(17) Applications for revaluation of answer-books will not be entertained.

(18) The marks of each examination will be communicated to candidates along with results free of charge.

(19) **The Institution reserves the right to cancel the result of any candidate without assigning reasons, in which case, the marks will not be supplied.**

(20) In any future correspondence in regard to the November 1963 examinations, candidates should always mention the Section of the Associate Membership Examination in which they appeared and their centre of examination in November 1963.

THE INSTITUTION OF ENGINEERS (INDIA)

8 Gokhale Road, Calcutta 20

November 1963 Examinations

Programme

Days	S.T. 10.00 to 1.00	S.T. 2.00 to 5.00
	Studentship Examination	
Monday, November 4, 1963	English	Mathematics I
Tuesday, November 5, 1963	Mathematics II	Physics
Wednesday, November 6, 1963	Chemistry	
	Associate Membership Examination—Section A	
Monday, November 4, 1963	Mathematics I	Mathematics II
Tuesday, November 5, 1963	Applied Mechanics	Principles and Applications of Heat, Light and Sound
Wednesday, November 6, 1963	Principles and Applications of Electricity	Theory of Structures and Strength of Materials Theory of Machines Elementary Electrical Engineering Applied Chemistry Physical Chemistry and Organic or Inorganic Chemistry
	Associate Membership Examination—Section B	
Monday, November 4, 1963	Engineering Materials	Engineering Drawing I
Tuesday, November 5, 1963	Engineering Drawing II (from 10.00 a.m. to 1.00 p.m. and 1.30 p.m. to 4.00 p.m.)	
Wednesday, November 6, 1963	Theory and Design of Structures Diffusional Processes. Evaporation and Distillation Chemical Works Organization and Management	Electrical Engineering General Geology Fuels and Combustion
Thursday, November 7, 1963	Irrigation Water Supply and Sanitary Engineering Hydro-Electricity Agricultural Engineering Machine Design Mining Metallurgy Mechanics of Fluids	Thermodynamics and Heat Engines Metallurgy Transport and Storage of Materials Principles of Heat Transmission and Furnaces Soil Mechanics and Foundation Engineering
Friday, November 8, 1963	Workshop Technology Engineering Chemistry Electrical Installations Electrical Measurements Electric Traction Ultra-High Frequency Technique Including Radar and Centimeter-Waves Electro-Chemistry Industrial Stoichiometry	Building Construction Stability and Resistance of Ships Gas Engineering Principles of Mining Metrology and Machine Tools Electricity Supply Instruments and Automatic Control in Chemical Industry Chemical Works Design and Construction Size Reduction, Mixing and Separation
Saturday, November 9, 1963	Hydraulics and Hydraulic Machinery Roads Town Planning Harbours and Docks Architecture Line Communication Railways Power Generation and Distribution in Chemical Works	Electrical Machinery Geodesy Radio Communication Principles of Heat Transmission, Heat Transfer Equipment, and Refrigeration Materials and Mechanical Construction of Chemical Plants
Monday, November 11, 1963	Industrial Engineering and Management	Refrigeration and Air-Conditioning Aeronautics

Form 362

THE INSTITUTION OF ENGINEERS (INDIA)
8 Gokhale Road, Calcutta 20

November 1963 Examinations (New Scheme)
General information and instructions to candidates

(Approved by the Examinations Committee, 51st Meeting, Resolution 21, 30th December, 1958)

(Revised by the Examinations Committee, 57th Meeting, Resolution 19, 27th - 29th June, 1961, and 58th Meeting, Resolution 10, 13th and 14th October, 1961).

(1) The next Associate Membership (Sections A and B) Examinations (new scheme) will be held from Monday, November 4, 1963 to Monday, November 18, 1963, both days inclusive. The application forms for the Associate Membership (Sections A and B) Examinations (new scheme) and the programme of examinations are attached to this Bulletin.

(2) **All applications accompanied by examination fees for admission to the November 1963 examinations should reach the Head Office before 4 p.m. on Monday, September 16, 1963.** Examination fees once paid are neither refundable nor transferable to a subsequent examination or to any other account. Receipt of examination forms will not be acknowledged by the Head Office, unless accompanied by a self-addressed post-card.

(3) **Examination fees should be preferably deposited at the State Bank of India in the candidates, locality. Attention of the candidate is specially drawn to item 3 in Form 363 and item 5 in Form 364 in this regard. The instructions for making such payment are given in Card A (attached herewith) and on its reverse. Other modes of payment may be used only if this is not possible. Payment of examination fees by cheque will not be accepted.**

(4) No application for a change of examination centre will be entertained after 4.00 p.m. on Monday, September 16, 1963.

(5) Students who are in arrears of subscription will not be admitted to the examinations.

(6) **The Institution reserves the right to reject incomplete or illegible applications without any reference to the candidate.**

(7) No Student will be permitted to appear in the Section B examination unless he has fully passed the Section A examination or secured exemption therefrom. A candidate for the Section B examination should therefore mention the year in which he passed the Section A examination.

(8) Students appearing for the Section B examination under the revised rules 11.2.1 to 11.2.9 of the rules of examinations (see 'Rules and Syllabuses of Studentship and Associate Membership Examinations') should clearly state in the application form the name of the Local Centre to which they are attached.

(9) A candidate who has already passed the Section A and B examinations or is exempted therefrom will be permitted to appear in any paper or papers of Section A and/or Section B (new scheme) on payment of an examination fee of Rs. 50.00 per paper. The details of passing the Section A and B examinations or of exemption therefrom should be clearly stated in the examination form, with the grade of membership.

A candidate may also appear in one complete branch of engineering on payment of usual examination fee of Rs. 75.00. Rules of examination for such a candidate will be identical with those applicable to regular candidates.

(10) Candidates are not permitted to use handbook(s) for the paper in 'Design and Drawing' of Section B. They may, however, use steel tables of the Dorman Long type.

(11) Candidates detected using unfair means in the examination hall will be expelled from the Institution and will not be readmitted to the Institution at any future time.

(12) It is sometimes found that candidates do not enter their Studentship Number, Roll Number, or other necessary particulars on the answer-books. Such answer-books will be rejected and no attempt will be made to locate the candidates. Candidates should therefore take particular care to write down these particulars on the answer-books correctly.

(13) The results of the November 1963 examinations (new scheme) will be declared before the last day of February 1964.

(14) Application for revaluation of answer-books will not be entertained.

(15) **The marks of each examination will be communicated to candidates along with results free of charge.**

(16) The Institution reserves the right to cancel the results of any candidate without assigning reasons, in which case, the marks will not be supplied.

(17) In any future correspondence in regard to the November 1963 examination (new scheme) candidates should always mention the Section of the Associate Membership Examination in which they appeared and their centre of examination in November 1963.

THE INSTITUTION OF ENGINEERS (INDIA)
8 Gokhale Road, Calcutta 20

November 1963 Examinations (New Scheme)

Programme

Days		S.T. 10.00 to 1.00	S.T. 2.00 to 5.00
Associate Membership Examination—Section A			
Monday,	November 4, 1963	Mathematics I	Mathematics II
Tuesday,	November 5, 1963	Applied Mechanics	Principles and Applications of Electricity
Wednesday,	November 6, 1963	Heat, Light and Sound	Engineering Drawing
Thursday,	November 7, 1963	Strength of Materials	Elementary Surveying
Associate Membership Examination—Section B			
Monday,	November 4, 1963	Materials and Construction Mechanical Engineering Materials Electrical Engineering Materials Chemical Engineering Materials Principles and Practice of Coal Mining Mineral Dressing Electronics and Telecommunication Materials	Theory and Design of Structures Industrial Organization and Management Theory and Performance of Electric Machines Industrial Stoichiometry and Mechanics of Fluids Principles and Practice of Metal Mining Physical Metallurgy and Physical and Mechanical Testing of Metals General Electrical Engineering
Tuesday,	November 5, 1963	Structural Engineering Hydraulics and Hydraulic Machinery Generation. Transmission and Distribution of Electric Power Diffusional Processes, Evaporation and Distillation Mine Ventilation, Explosions, Fire and Inundation Refractories Applied Electronics and Circuits	Surveying and Geodesy Theory of Machines Electric Traction Fuels and Combustion Mine Surveying Foundry Engineering Transmission Lines and Net-Works
Wednesday,	November 6, 1963	Hydraulics Industrial Engineering Illumination Engineering Elementary Electrical Engineering Mineral Dressing Practice Metallurgical Analysis Advanced Radio and Electronic Engineering	Irrigation Engineering Refrigeration Line Communication Gas Engineering Mining Geology Industrial Metallurgy Antenna and Wave Propagation
Thursday,	November 7, 1963	Civil Engineering Design and Drawing Mechanical Engineering Design and Drawing Electrical Engineering Design and Drawing Chemical Engineering Design and Drawing Electronics and Telecommunication Design and Drawing	(From 10 a.m. to 1 p.m. and 1.30 p.m. to 4 p.m.)
		Mining Machinery Physics of Metals	Generation, Distribution and Utilization of Power in Mines Metallurgy of Less Common Metals

Programme—(*Contd.*)

Friday, November 8, 1963	Architecture Air-Conditioning Radio Communication Materials and Mechanical Construction of Chemical Plants Mine Design and Planning Metallurgical Thermodynamics Radio Communication Systems	Soil Mechanics and Foundation Engineering Aerodynamics Hydro Power Engineering Metallurgy Mine Organization and Management Engineering Metallurgy Audio Frequency Engineering
Saturday, November 9, 1963	Public Health Engineering Railway Locomotives and Rolling Stock General Electronics Refrigeration and Air-Conditioning Mine Economics Electrometallurgy and Hydrometallurgy Electronic Measurements	Town Planning Automobile Engineering High Frequency Currents Chemical Works Organization and Management Metallurgy and Assaying Fuels and Furnaces Industrial Electronics
Monday, November 11, 1963	Highway Engineering Fuels and Refractories Radar Engineering and Microwave Techniques Workshop Techonology	Harbours and Dock Drilling Engineering Television Utilization of Electric Power Principles of Heat Transmission and Furnaces
Tuesday, November 12, 1963	Thermodynamics and Heat Engines Size Reduction, Mixing and Separation Telegraphy and Telephony	Agricultural Engineering Thermodynamics Carrier Current Engineering
Wednesday, November 13, 1963	Metallurgy of Iron and Steel Industrial Administration	Geology Production Technology Non-ferrous Metallurgy
Thursday, November 14, 1963	Railways General Mechanical Engineering	Water Power Engineering Electrical Measurements Heat Treatment of Metals and Alloys
Saturday, November 16, 1963	Thermal Power Engineering Servomechanisms	Production Technology and Industrial Engineering Principles of Semiconductors and Transistor Circuits
Monday, November. 18, 1963	Principles of Line and Radio Communication	

THE COUNCIL 1962-63

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Dr. T. Sen

Vice-Presidents

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K. Barua (*Assam*)
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K. L. Mathur

Uttar Pradesh

K. N. Misra*
A. C. Mitra
R. D. Varma

Secretary

B. Seshadri

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* Names repeated

BULLETIN OF

THE INSTITUTION OF ENGINEERS (INDIA)

PLEASE SEE NOTICE FO[illegible]ING OF CORPORATE
MEMBERS FOR REVISION [illegible]AWS AT CALCUTTA,
OCTOB[illegible]963

Vol. 12, No. 12, AUGUST 1963
&
Vol. 13, No. 1, SEPTEMBER 1963

Supplement to the *Journal of the Institution of Engineers (India)*,
Vol. 43, No. 12, August 1963 & Vol. 44, No. 1, September 1963

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8 GOKHALE ROAD
CALCUTTA

Rs. 5.00

EMPLOYMENT SERVICE

This service is intended for the benefit of members of the Institution and for the Government, industrial and other organizations employing engineers. It is hoped that the employers will make full use of this service to obtain their requirement.

A small charge of Rs. 5 per insertion will be made to members for notices appearing in the 'Situations Wanted' column.

In the 'Situations Vacant' column a charge of Rs. 2 per line will be made.

Replies to advertisements should be addressed to Employment Service, The Institution of Engineers (India), P. O. Box No. 669, Calcutta 20, except where otherwise stated.

SITUATIONS VACANT

1. Applications are invited for positions of MECHANICAL ENGINEER in a new Indian factory about to embark on the manufacture of construction equipment and fabricated structural items.

No foreign collaboration is proposed, and the successful candidates will therefore have to assume various degrees of responsibility in the preparation of project reports (which may include market surveys), the preparation of technical layouts, acceptance of raw materials, design and production of equipment and their installation and erection, testing to ensure conformity with specifications, and technical liaison with customers.

Recent experience in one or more of these aspects would be particularly relevant. The appointments offer good opportunities for advancement for the right men. Salary will be commensurate with the candidate's experience and ability.

Applications stating age, qualifications and experience should be sent addressed as above directed, quoting Office ref. E.S. 127.

2. EXPERIENCED SHIFT ENGINEERS required for power stations in Uttar Pradesh.

Duties :	Operation and maintenance of modern steam power stations up to 20,000 kW capacity.
Qualifications :	Engineering degree, 5 years experience in operation and maintenance of high pressure boiler units of up to 75,000 lb. per hr. and steam turbo-alternator sets up to 5 MW capacity, also operation and maintenance of high voltage switchgears up to 11 kV.
Salary :	All applications will be treated in confidence. (Office ref. E.S. 129)

SITUATIONS WANTED

1. ASSOCIATE MEMBER of the Institution of Engineers (India), age 42 years, having 20 years teaching experience in Civil Engineering in Government technical institutions, the last five years in a responsible position, seeks suitable position in polytechnics or other technical institutions. (Office ref. E.S. 128)

2. ELECTRICAL ENGINEER, B.Sc.(Hon.), B.Sc. (Eng.), A.M.I.E., First Class Boiler Engineer, aged 35 years, with practical experience of ten years in generation and distribution of power at 6.3 kV and 440 V, repairs and maintenance of turbo-alternators, water-tube boilers, power transformers, a large number of different types of motors including variable speed and 6.3 kV synchronous ones with their switchgear, automatic and variable speed controls, along with installation of electrical equipments of modern machines in big reputed concerns, seeks a change for suitable position of responsibility in a reputed concern. (Office ref. E.S. 127)

Rai Bahadur N. K. Mitra

Rai Bahadur N. K. Mitra, O.B.E., B.Sc.(Hon.), B.Sc.(Eng.), M.I.E., who was the President of the Institution for 1947-48, died in Calcutta on June 16, 1963. He was 76.

Born in 1887 at Raiskati, Barisal (now in East Pakistan), he graduated in Science from the Presidency College, Calcutta, in 1909. He obtained the B.Sc.(Eng.) degree of the Glasgow University with special distinction in Natural Philosophy in 1912.

He then worked with Sir Douglas Fox and Partners, Civil Engineers, London, for five months, and in the construction of the Liverpool street extension of the Central London Tube Railway for a month. He also worked as Apprentice Engineer in the Great Central Railway for one year at Sheffield and Manchester.

In 1913, he joined the East Indian Railway as Assistant Engineer, and in 1921 he became Resident Engineer. He had been in charge of Way and Works Division of the Howrah and Loop Districts of the East Indian Railway, when he had carried out remodelling of the Bandel yard, Bandel drainage scheme, and remodelling of the Burdwan yard. He was promoted as Divisional Superintendent in 1937, and became Chief Engineer of the East Indian Railway in 1941. During the years of the Second World War, he organized the construction of many military bases and transport facilities in record time.

Soon after his retirement, he was appointed by the Railway Board as Chairman of the Housing Committee which was formed to prepare a scheme for the provision of staff quarters for railway employees. In 1946, he attended the International Engineering Conference in Paris, as a delegate of the Government of India. On his return to India, the Railway Board again utilized his services as part-time Adviser to the Building and Research Organization. He was Chairman of the Construction Board founded by the Government of West Bengal for construction of houses all over the State for rehabilitation of displaced persons. He was also associated with many other organizations. He was Chairman of the Board of Studies, All-India Council for Technical Education, Trustee, Calcutta Improvement Trust, and President of the Rotary Club in 1955-56.

Rai Bahadur Mitra joined the Institution as Member in 1925.

The Headquarters Office of the Institution was closed on June 17, 1963, as a mark of respect to his memory.

Sir Thomas Guthrie Russell

Sir Thomas Guthrie Russell, K.C.S.I., K.C.I.E., B.Sc.(Eng.), M.I.C.E., M.I.E., who was President of the Institution for 1933-34, died in Glasgow, Scotland, on February 3, 1963. He was 76.

Born in 1887, he was educated at the Glasgow University, and was apprenticed in 1909-11 to Nivan & Haddin, Civil Engineers, Glasgow. His first appointment was with the North British Railway between 1911-13.

He arrived in India in November 1913, and was attached as Assistant Engineer to the *ex*-G.I.P. Railway. He was appointed Resident Engineer in 1919, and then became Agent in 1927. He joined the Railway Board as Member in 1928, and was Chief Commissioner of Railways from October 1929.

He was awarded the K.C.I.E. in 1932.

In 1939-40, Sir Thomas was President of the War Transport Board, India, and held the post of Director-General of Munition Productions until 1943. In 1944-46 he was Regional Red Cross Commissioner, South India. Sir Thomas retired from service and left India in 1946, He returned for a short visit in 1955.

He joined the Institution as Member in 1930.

The Headquarters Office was closed on February 12, 1963, as a mark of respect to his memory.

Page 13, Additional List of Referees for Students appearing in Section B of the Associate Membership Examination—under Bihar Centre, instead of :—

'32. AM 3268 Prof. Sidheswar Prasad (C)
Executive Engineer, Concreting, D.V.C. Panchet Project, P. O. Panchet Dam, Dist. Dhanbad.'

please read

'32. AM 4260 Prof. Sidheswar Prosad (C)
Bihar Institute of Technology, P. O. Sindri Institute, District Dhanbad.'

Page 21, Roll No. 295B, instead of 'Bhobani Coomar Coondo' please read 'Bhobani Coomar Coondoo'.

OBITUARY

The sympathy of the Institution is extended to the relatives of those whose passing is recorded here.

Mr. A. C. Coubrough

Mr. Anthony Cathcart Coubrough, C.B.E., M.A., B.Sc. (Eng.), M.I. Mech. E., M.I.E.E., M.I.E., who was President of the Institution for 1922-23, died in Witham, Essex, England, on January 26, 1963. He was 86.

Born in 1877 in Glasgow, he obtained his general education at the Albany Academy, Glasgow, Glasgow University. He was apprenticed at the Salford Iron Works, Manchester, of Mather & Platt Ltd. Subsequently, he held various appointments such as Electrical designer, Manager of Electrical Engineering Department, and Travelling Representative in India and Africa in the Company. In his engineering career, he carried out many responsible works amongst which his association with the electrical equipment for the Widnes-Runcorn Transporter Bridge system of the Admiralty Dockyard, and his patent for an alternator for electro-chemical works are important contributions.

Later, he came to Calcutta as General Manager for India of Mather & Platt Ltd. In 1919, he held the position of Controller, Munitions Manufacture, Indian Munitions Board, Simla. On his return to England, he joined the Imperial Patent Service, London, as Technical Adviser.

During the years of his stay in India, the need for a Society for the advancement of engineering science in India hardly required demonstration. He was a founder-Member of the Institution and one of the original handful of men who were responsible for the formation of the Indian Society of Engineers during 1919-20, which laid the further foundation to the Institution as it stands today.

and patterned ground, (iii) phase equilibria and transitions, (iv) thermal aspects, (v) physico-mechanical properties of frozen ground, (vi) exploration and site selection, (vii) sanitary and hydraulic engineering, (viii) earthwork and foundation engineering, and (ix) research needs, are included in the programme. Papers are invited for consideration and for possible inclusion in the conference discussion and for publication in the *Proceedings*.

Further particulars of the conference can be obtained from Building Research Advisory Board, 2101 Constitution Avenue, N.W., Washington 25, D.C.

The Third International CIB Congress, Copenhagen, June-July 1965

The Third Congress of the International Council for Building Research, Studies and Documentation (CIB) will be held in Copenhagen, Denmark, during June-July 1965. The choice of the congress theme is based on the conviction that the growing building needs necessitate an industrial approach, whether applied in areas where relatively simple and traditional constructions must be provided in large quantities, using a relatively large available labour force, or, applied in areas where the industrial pattern of the economy makes it possible and advantageous to undertake a substantial amount of complete prefabrication.

The programme of the congress will include as subjects the organization and productivity of the building process, the determination of functional requirements, and provision of knowledge to the practitioner. Special attention will also be devoted to the specific problems of those countries that are faced with the need of sudden and rapid industrial development. It is expected that the congress will, in this way, be complementary to a more limited United Nations Seminar on 'Modifications in the Structure of the Building Industry' to be held in 1964 in Prague.

Members who are interested to receive further information may contact the General Secretary of CIB, P.O. Box 299, Rotterdam, The Netherlands.

Fifth Congress of the Fédération Internationale de la Précontrainte, Paris, June 13-18, 1966

The Fifth Congress of the Fédération Internationale de la Précontrainte (F.I.P.) will be held in Paris from June 13-18, 1966. Registration of delegates will begin on June 11, 1966, and the opening session will be held on 12th June. Technical sessions and visits will be held during the week. Further details concerning the Congress will be announced later.

CORRIGENDA

TO VOL. 12, NO. 9, MAY 1963

Page 20, Roll No. 6562 A, instead of 'Kanak Kishore Prasad', please read 'Janak Kishore Prasad'.

A Combustion Chart to Interpret Exhaust Gas Analysis

Prof. T. R. Sarkari

Associate Member

A lot of information on combustion characteristics can be obtained from the results of analysis of exhaust gases from internal combustion engines and boilers. The analysis may serve to interpret very useful combustion data and the combustion conditions of internal combustion engines and boilers, provided we know the chemical composition of the fuel used. The purpose of this paper is to show how such information may be derived analytically. Using these derivations, the author has developed a new form of combustion chart to obtain quickly data relevant to combustion.

MINING AND METALLURGY DIVISION

Sixth World Petroleum Congress

Dr. J. W. Whitaker

Member

The Sixth World Petroleum Congress was held in Frankfurt-on-Main, West Germany, from June 19-26, 1963. A report on the Congress and the 'Interoil' —International Exhibition held in association with it are given in this paper. The author was one of the delegates of the Indian National Committee for the World Petroleum Congress.

INSTITUTION NOTICES

Existing Scheme for Sections A and B of the Associate Membership Examination

Candidates wishing to appear for the first time in Section A or Section B or those who have not secured any exemption previously under the existing scheme, will be given the option to appear under the existing or new schemes of examinations up to and including November 1963. If such candidates fail to secure exemption in at least one subject of the existing scheme by November 1963, they will have to appear in the respective Sections under the new scheme from May 1964.

FORTHCOMING CONFERENCES

International Conference on Permafrost, Purdue University, Lafayette, U.S.A., November 11-15, 1963

The Building Research Advisory Board of the National Academy of Sciences—National Research Council, U.S.A., will present an International Conference on Permafrost to be held at the Purdue University, Lafayette, Indiana, U.S.A. The conference will provide a forum for the international exchange of scientific information on the fundamental properties and behaviour of frozen ground. Papers on specific topics in the subjects of (i) surficial monphology, (ii) massive ground ice, gelifluction

RAILWAY ENGINEERING GROUP

Trends in Wagon Design of Indian Railways

P. C. Neogi

Member

The Indian Railways with a network of 35,000 track-miles in three gauges form the largest railway system in Asia. It handles a wide variety of freight traffic which is rapidly expanding with the increasing pace of industrialization and has risen from 114 to 168 million tons per year in the Second Plan, with an expected increase to 260 million tons after the Third Plan. The fleet of freight cars is consequently not only large but consists of different types such as open cars, covered cars, 4-wheelers, bogies, etc., to suit the commodities to be handled. A programme of modernization is on the way to make their designs more efficient from the point of view of economy, speed and safety. The programme of procurement and replacement of wagons is also large involving an expenditure of about Rs. 175 crores in the Second Plan. The design of wagons has to take into account the type of commodity to be carried. It is also limited by other basic considerations such as (i) permissible moving dimensions, (ii) standard of track loading, (iii) permissible degree of curvature, and (iv) standard of bridge loading. The effect of these factors is discussed in the paper.

MECHANICAL ENGINEERING DIVISION

Principle of Operation and Design of a Three-Component Cutting Force Dynamometer

A. Chakravarty

Associate Member

The principle of operation and design of a three-component dynamometer, which can be used to measure the cutting force components in various types of machining operations, is described in the paper.

Stability Analysis of Composite Surge Tanks

R. N. Ingle

Non-member

and

A. K. Chaudhuri

Associate Member

The paper gives the theory of stability for a type of composite surge tank, in which an expansion chamber is connected to the main surge tank by means of an expansion gallery. Stability criteria for composite surge tanks considering the effects of a long penstock and a realistic governor are established in terms of the areas of the main and secondary surge tanks. Stability plots indicating the limits of stability in terms of the areas of the main and secondary surge tanks are given for common values of available heads and frictional losses in hydro-electric projects. The minimum areas of main and secondary surge tanks required for stability can be obtained from these plots.

Measurement of Thermal Resistivity of Soils at Chittaranjan

M. L. Gupta
Non-member
and
B. C. Raychaudhuri
Non-member

The rating specifications of underground high voltage electric cables are decided by the thermal resistivity of soils in which the cables are to be laid. Though measurements on the resistivity of soils have been conducted abroad on an extensive scale, no such measurements have been done on soils in India. The paper presents the results of experimental investigations conducted on the thermal resistivity of soils at Chittaranjan, West Bengal. While the *in-situ* method of direct measurement was adopted for these investigations, theoretical computation of the thermal conductivity of soils by Gemants' approximate theory were also done for the sake of comparison.

Flume Studies of Drag on Bridge Piers

A. G. Mirajgaoker
Non-member
and
B. Suryanarayana
Non-member

The paper presents the studies carried out to investigate the relationship between drag coefficient and Froude number for two forms of bridge pier models in a 3 ft. wide masonry flume. It was observed that the drag coefficient has an inverse relationship with the Froude number in the subcritical and supercritical regions of flow. A transitional stage was observed to exist in the critical flow region. Based on these studies, two relationships of the form $C_D = a F^{-b}$ are proposed for the subcritical and supercritical flow regions.

Training of Tawi River

Dr. H. L. Uppal
Member

The Tawi River, a major tributary of the Chenab, flows north-east of Jammu city. The river separates the city from the cantonment the city being on the right bank and the cantonment on the left bank. After partition, the road bridge over the river is as the only link on the highway connecting the rest of India with the State of Jammu and Kashmir. The paper discribes the author's observations and proposals for strengthening the abutments and bridge piers and for training the river.

Summaries of Papers Published in the Journal, Vol. 43, no. 11, pts. CI 6, ME 6 & MM 3, July 1963

CIVIL ENGINEERING DIVISION

Design of Rubble Mound Breakwaters

Maj. G. N. Bajpai

Associate Member

This paper presents the problems involved in the design of rubble mound breakwaters. Criteria for determining configuration and location of breakwaters, size of armour stone, use of tetrapods, size of subsurface stones, determination of slope, crown width and elevation and parapets, design of interior sections, thickness of protective covering, design of round head, specifications for stone, maintenance considerations, type of foundations, and the necessary model experiments are discussed. Some problems for further research are also indicated. The designer, it is felt, may find the information contained in the paper handy, useful and practical.

Exit Loss in a Sharp Edged Pipe

B. S. Basavarajaiah

Associate Member

Loss of head takes place in all types of flow. In pipe flow, loss of head is due to entry, sudden expansion and contraction, and friction. Loss of head also takes place at the exit of a sharp edged pipe when the pipe discharges under water. So far, it was considered that this loss of head is equal to the velocity head, *i.e.*, that the kinetic energy of the flow is completely dissipated. This assumption is based on the application of Borda-Carnot's equation for calculation of loss of head due to sudden expansion. Loss of head at the exit of a sharp edged pipe is altogether different from loss of kinetic head, and is of a large magnitude in the case of short length pipes. The exit loss is also expressed in terms of the velocity head by introducing a coefficient. This coefficient is either equated to zero or given a higher value. The paper deals with the analysis of exit loss when a sharp edged pipe discharges under water. A formula is developed for the determination of the coefficient of exit loss, which is expressed as a function of Reynold's number.

Stabilization of *Mar* Soil

D. N. Bhargava

Non-member

and

A. N. Harkauli

Associate Member

The paper presents experimental results for stabilizing a typical expansive clay, called '*mar*' occurring in the Bundelkhand region of Uttar Pradesh, by lime and *surki* admixture and suggests suitable proportions for use in the field.

The next factor governing the training is the range of management activities. For obvious reasons, most of the army work cannot be given out on contract. Hence, it becomes necessary for the workshops to plan, organize and execute the repairs by selves. Whereas in the field the craftsmen are all combatants requiring the army pattern of man-management, in the base workshops, the staff is predominantly civilian where personnel management takes on a different aspect. The officers in the middle and higher appointments have, therefore, to exhibit qualities of management which are flexible, adaptable and equitable under different circumstances. This calls for training in general management with emphasis on industrial psychology, factory legislation, and civilian personnel management and allied subjects. This is in addition to the normal military training in the field of military administration. In the case of base workshops, there is need for emphasizing on industrial management training as the officers have to deal with the problems connected with planning, production, production control, materials control, inspection, financial control and administration. Industrial management training is, therefore, imparted at the EME School both at the middle and higher levels of command. An essential requirement of management is to ensure high productivity. A scientific tool in our hands to achieve this is work study. I am proud to say that we, in the Corps, started work study as far back as 1949. Today, there is a work study team in every Central EME Workshop and this aspect of scientific management is given due emphasis in the training of officers and men. In addition to the above, a large number of civilian technical personnel are also required for employment in the static workshops. Whilst some of them may be available from the output of the industrial technical institutes, a scheme for training civilian craftsmen has also been started in the Central EME Workshops.

It will be obvious that the type of man required by the Corps should be resourceful as well as versatile in his technical skill. He must have an adventurous outlook and be able to take to all types of climate and terrain and be a soldier at heart. It is not possible to match the material remuneration which other walks of life can offer to such personnel, but the Corps can offer them something that would be more satisfying to individuals of that calibre, *viz.*, a really challenging engineering profession, variety in employment, comradeship and *esprit de corps.* I am sure that the country will be able to produce the necessary number of the desired type of personnel.

With the rapid advances in technology, the equipment of the army is undergoing vast changes. Hydraulic and servomechanisms are being utilized increasingly in modern weapons of war. Electronics has come into play in most of the army equipment, whether it be in the matter of communications, or, ack-ack armament, or tanks. In the field of electronics, there has been a vast development with the introduction of transistors. It will be appreciated that an army to be effective will have to equip itself with modern weapons. It is therefore necessary that the Corps of Electrical and Mechanical Engineers should always be alive to the developments in the field of weapons and equipment. The training for personnel of the Corps, whether it be at the EME Centre, the EME School or in foreign countries, has to keep pace with such developments and in fact must be ahead of the introduction of modern weapons of war. This is essential to ensure that lack of technical knowledge will not unduly delay the introduction of more modern weapons into the Services'.

There is a shortage of trained craftsmen in the country. In view of monetary and other considerations, very few trained personnel are available for enrolment as combatants in the Corps. Moreover, some of the trades such as armourers, gun fitters, armoured fighting vehicle mechanics and radar mechanics are rather peculiar to the Services. Therefore, it becomes necessary to train raw hands both as soldiers and as craftsmen after recruitment. This is done at the EME Training Centres. The Training Centre at Secunderabad has capacity for training a large number of combatant-craftsmen. The recruit is initially given military training and then allotted a trade in accordance with his education and technical aptitude. To determine his technical aptitude, certain psychological tests are given. The trainee then undergoes technical training for a period ranging from 9 to 18 months. In the case of more skilled trades such as armament fitters, telecommunication mechanics and instrument mechanics, the later phase of the training is given at the EME School at Secunderabad. The trained combatant is passed out from the EME Centre or the EME School, as the case may be, as class III tradesman. Whilst the majority of the trained men attain more experience and pass further tests in their units for being upgraded to class II or I, the more skilled trades are given additional training at the EME School or the Centre before being upgraded to the higher classes. This training is given after they have gained sufficient practical experience as class III or II craftsmen in the workshops. There are over 20 different trades in the Corps to deal with repair work of varied types of equipment. The EME School also trains senior NCO's as armament artificers who are the highest grade of technicians and supervisors in the Corps. The training imparted to them is equivalent to a diploma covering general engineering with emphasis on certain ranges of equipment. They form the hard core of the middle piece of management.

Basically, the requirement is for trained engineers as officers in the Corps. It is also desirable that a certain proportion of the officers are trained together with those in the fighting arms. Officers for the Corps are therefore found from two sources—engineering graduates from the universities and cadets entering through the National Defence Academy and the Indian Military Academy. Both the categories undergo military training prior to being commissioned into the Corps. They then attend a basic course at the EME School. In this course, they learn the organization and administration of the army and the basic craftsmen skills, and gain sufficient knowledge of repair work of various types of equipment so that when posted to workshops they are able to command sub-units. After gaining experience in the workshops for about 2 years, the non-graduate officers are sent to a degree engineering course at the College of Military Engineering. At the end of about 6 to 8 years service, both graduate and non-graduate officers attend advanced automotive, armament or telecommunication courses at the EME School. The training in these courses covers not only the basic design principles but the development and repair techniques of the equipment. The standard of training is comparable to post-graduate courses. The training of officers and men, therefore, covers a wide range of techniques and manufacturing processes. The complexity of the spheres of employment calls for technical ingenuity, knowledge and skill of a great magnitude. The problem is very much different from that of training a person to a specific task.

Since army equipments, especially vehicles, have to operate in difficult terrain, it will be obvious that often they are likely to go off the road or get ditched. During operations, vehicles and other equipments, especially guns, are likely to be damaged as a result of shell fire, mines and other causes. It is essential that such damaged vehicles and other equipment are recovered immediately and brought back to the workshops for repair. Moreover, communication facilities in some of the remote areas being restricted to a few roads, it is essential that they are kept free from obstructions to ensure free flow of traffic. For this purpose, recovery units are provided, which have specialist recovery or breakdown vehicles equipped for extricating vehicles from difficult positions and for towing them to the workshops for repair. The work undertaken by the recovery units is hazardous at times as recovery has to be carried out under enemy fire.

Inspection of the repair work carried out in the base workshops is just as necessary as in a manufacturing plant. Inspection standards for overhaul are therefore required in respect of the various equipments and components of these equipments. Such inspections are the means to control the quality of the repairs done Reliability of the equipment that is overhauled in the base workshops has to be assured to the users to create confidence. Laying of inspection standards and carrying out actual inspections are the responsibility of the Technical Services Group which forms a part of the Corps of Electrical and Mechanical Engineers. This Group is also responsible for preparing technical instructions, workshop manuals and scales for spares, investigating defects in army equipments, and evolving modifications.

To keep the repair and maintenance efforts to the minimum, it is necessary for the Corps of Electrical and Mechanical Engineers to be closely associated with the design aspects of the equipments. Since an accurate assessment of the reliability of new equipment is not possible, qualities such as durability and ease of repair and maintenance are specified. Durability can be defined as the quality of resisting wear and physicochemical changes. This may be given in terms of mileage in the case of vehicles or the number of rounds in the case of gun barrels. While the manufacturer would accept designs which are easy to produce, the Corps of Electrical and Mechanical Engineers has to ensure that they permit ease of maintenance and repair. For this purpose, the Technical Services Group is associated with the various research and development panels dealing with the design and development of different types of army equipment. They are also associated with the user and the technical trials of the prototypes before the equipment is accepted and introduced into service. The Group is also responsible for keeping in touch with the developments in the field of production engineering and repair techniques. For this purpose, visits are often paid to industrial concerns and other organizations. Information is obtained during such visits on the technical knowhow of the various aspects of production work as well as on the development of new types of repair material and test gear. Technical bulletins are issued by the Technical Services Group for the information of the EME Workshops.

It will be realized that to fulfil its role the Corps of Electrical and Mechanical Engineers require a large number of skilled craftsmen as well as technical officers. It is not only necessary that both these categories of men should be skilled in their profession but should be soldiers so that they can man the units in the field.

comprises the exchange of major assemblies such as the engine and the gear box, and repair of equipment and assemblies. They are also capable of a limited amount of incidental manufacture. Major repairs including complete stripping and overhaul are undertaken in the base workshops. These workshops are static establishments where engineering aspects are given greater importance. A number of Central EME Workshops, which carry out base repairs to army equipment, are located in various stations. These employ a large number of civilian workers. Some of them specialize in the repair of armament, electronic equipment, instruments or earthmoving machinery, whereas the others undertake repair of tanks, vehicles and other associated equipment. To support this, a fair amount of manufacture is also undertaken by such workshops. It will be appreciated that the Central EME Workshops deal with a large range of engineering works. Apart from the overhaul of a variety of technical equipment and vehicles, the engineering processes involved in the manufacturing and reclamation activities cover almost every process of electrical, mechanical and electronic engineering. I will mention a few of the specialized engineering processes that are being carried out :

(a) Plastic moulding of components like control knobs for wireless sets and traffic reflectors ;

(b) Reclamation of worn out components like crankshafts and bearing housings by metal spraying. In fact, we are the pioneers in this country in adopting this process on a large scale ;

(c) Building up or surface hardening of cylinder linears and Diesel engine fuel pump components by chrome deposition ;

(d) Welding with supernicron electrodes for reclamation of cracked cylinder heads ;

(e) Low temperature eutectic welding for reclaiming light alloy parts such as carburettor bodies ;

(f) Hot dip aluminizing processes for increasing the life of mufflers and silencers ;

(g) Galvanizing and chromat treatment of petrol tanks ;

(h) Phosphating of small arms; and

(j) Rubber bonding to metal parts in the case of solid rubber tyres and other automotive components.

The Central EME Workshops have been manufacturing a limited quantity of liners, pistons, piston rings, coils, chokes, rubberized items and other components which are not readily available in the market. Some specialized workshop equipments are also manufactured by these workshops. Some examples are: litz wire making machines, coil impregnation plants and transistorized stethoscopes for engine noise detection. New processes are under constant investigation for adoption. At present, the application of nucleonics for the study of problems such as wear of piston and piston rings and for establishing the relationship between piston ring rotation and frequency of decarbonizing is being undertaken. These examples have to be viewed in the context of the size of the commitment to get a correct idea of the engineering works undertaken by the workshops.

Though the Indian army was still slow in mechanization, the Western armies brought into use track laying fighting vehicles, *i.e.*, tanks, mechanical transport, artillery and wireless communication, at an unprecedented scale, and in 1926, RAOC formed a new branch with qualified engineers as its officers, and this branch took over the repair of armaments, armoured fighting vehicles and a part of the mechanical transport. Between the wars, mechanization increased keeping pace with the technological and industrial developments in other countries. In 1939, the IAOC Workshop Branch was reorganized in India, going a step further than the RAOC Workshop Branch in the U.K., by concentrating the inspection, repair and recovery of all transport and technical equipments of the army. The Second World War brought in new problems for the army repair organization. By 1941, it was apparent that the technical resources required to maintain a modern army in operations were enormous. As a result of the recommendations made by Sir William Reveridge in connection with an investigation on the use of skilled manpower in the Services in the U.K., the Corps of Royal Electrical and Mechanical Engineers was formed in October 1942. Similarly, in India, the expansion of the army on account of war emphasized the requirement of a single organization for the repair and maintenance of weapons and equipment. With the arrival of American tanks in large numbers, the problem of their repair became acute and to cope with the problem, the Corps of Indian Electrical and Mechanical Engineers was formed in May 1943.

The Charter of the Corps of Indian Electrical and Mechanical Engineers is to repair all worn out, damaged or defective armaments, vehicles and other equipment, which cover a whole range of electrical, electronic, mechanical, automotive, optical and electromedical equipments of the army. The Corps is also responsible for the inspection and recovery of such equipment. The extent of its task can be appreciated only when the types, quantities and sophistication of equipment in a modern army are considered. This problem is further aggravated by the fact that one type of equipment is not usually concentrated in one place but all these types are spread throughout the army.

Maintenance of equipment in serviceable condition is a time and space problem. The right tradesmen and tools and spares should be available in the right place and at the right time. It is neither possible to stock a large number of spare parts in all the forward areas nor return all equipment casualties to the workshops at the base. It is, therefore, necessary in evolving a repair organization to decide what should be done and where. Though basic engineering principles have to be observed, certain military principles will have to be given overriding importance as the two are often in direct conflict. Hence, it is not possible to design just one type of repair workshop. The repair effort is, therefore, organized under three main categories—light aid detachments, field repair workshops, and base workshops.

Every major mechanized fighting unit has a light aid detachment under command. These are mobile units provided with hand tools and some special tools. They are in the form of first aid posts and undertake minor repairs of equipment and changing of sub-assemblies. A little further behind the forward units and at level with the brigade headquarters, field repair workshops carry out repairs to equipment which are beyond the capacity of the light aid detachments. These workshops are equipped with specialist vehicles fitted with powered machinery and test equipment. Generally, their work

ADDRESSES OF CHAIRMEN AT THE ANNUAL GENERAL MEETINGS OF THE LOCAL CENTRES

Delhi Centre

Chairman's address by Maj.-Gen. S. P. Vohra, M.I.Mech.E., M.I.E.E., M.I.E., at the 36th Annual General Meeting of the Centre on December 29, 1962.

After welcoming the Chief Guest, Shri T. T. Krishnamachari, Union Minister of Economic and Defence Coordination, and other invitees, Maj.-Gen. Vohra thanked the members of the Centre for electing him Chairman for 1962-63.

Delivering the Chairman's Address, he said, 'Our Institution has indeed been growing from strength to strength. It is playing an increasing part in bringing engineers together in the furtherance of engineering and progressive thinking, and in inculcating in them the realization of their obligations and potential in serving the nation. Today the primary aim of the whole nation is to make the country's defences strong and effective. Needless to say, engineers will have to play the most constructive part in achieving this aim.

It is my opinion that enough is not known about the army by those outside, for them to take interest and understand its requirements and problems. There are two distinct types of engineering in the army and two different Corps to deal with them. The first deals mainly with civil and field engineering, *i.e.*, laying and clearing mine fields, assaulting pill boxes and obstacles, construction of roads, buildings, water supply, and so on. This is the job of the Corps of Engineers, which is an important fighting arm to help the army as a whole to move and fight. The second which deals with the war and other technical equipment of the army, is the job of the Corps of Electrical and Mechanical Engineers. The topic of my talk today is, 'Electrical and Mechanical Engineering in the Army'.

The requirements of organized electrical and mechanical engineering effort in the army is an index of its fighting strength and development in three directions, *viz.*, the sophistication of its armaments and equipment, their variety, and their quantity. The earliest attempt to legislate in order to ensure the condition of equipment appears to have been in the year 1181 when the Assize of Arms was proclaimed by the King of England, holding the soldier responsible for the upkeep of his bow and arrows, pike, sword or battle axe and enjoining him to bequeath his arm to his heirs. That was all that was needed at that time. Then came the Siege catapults and other engines of war which called for skilled attention necessitating the introduction of soldier-craftsman. The developments of cannon and mortars with the use of gun powder brought forth the need for a separate corporate authority to provide and repair these weapons. In 1896, a separate corps called the Royal Army Ordnance Corps (RAOC) was formed to fulfil this need. The First World War saw a major breakthrough in the technical equipment of the army.

3. The Institution of Engineers should organize in recognized institutions part-time evening courses for our Student members, in collaboration with the Ministry of Scientific Research and Cultural Affairs.

Finally, the Institution of Engineers has responsibilities to the public at large. It is surely the duty of any professional body to speak out in public about what is needed for the public good in the field in which its expert knowledge applies, and about what, if anything, is going amiss in that domain. In my view, at least so far as this country is concerned, the Institution of Engineers has been far too reluctant to let its views be known on questions of this kind. It has, of course, rightly been unwilling to get involved in questions which may be thought to be political. But the big issues of economic prosperity and industrial vitality are not really political, and there is none better qualified to give the public guidance on the broad technological questions involved than this great professional Institution.

In conclusion, may I say again how greatly honoured I am by having been elected by you as President of the Institution. Perhaps our discussions will show that much of what I have said fails to get general endorsement from even my colleagues in the Council. However, if by having put my own views before you, I have been able at least to generate some thought and to make you to reexamine some of your ideas, I shall feel, and I hope you too will feel, that the time has not been wasted'.

next generation of professional engineers. I would urge them to take this as a part of their professional responsibility. I feel that the Institution of Engineers should give greater emphasis to this aspect of engineering education. We will have to maintain and develop a belief—a conviction—that in the last resort it is the sense of responsibility, the example, the initiative and the inspiration of the individual which counts, and that only if the Institution as a whole embraces a sufficient number of such responsible individuals, will the strength and prosperity of the Institution be assured.

Student Members

Divergent industries and different wings of the Defence establishments require a large number of qualified trained personnel. In addition to 30,000 engineering graduates that we would be turning out soon, we have on the Roll of the Institution 31,343 Student members. If we can canalize this enormous manpower in the proper channel, it will go a long way in removing the shortage of technical personnel. The Defence Department, as far as I understand, has already made arrangements for providing the necessary facilities. The Institution has so long been working as an examining body only, leaving the problem of training to the efforts of the students themselves. I request individual members, particularly those in industry, to look to this aspect of the problem and to arrange for proper theoretical training facilities in their establishments. Members of our Institution will, I am sure, be glad to take part in delivering lectures on theory whenever the call will come. The Council of the Institution will, I hope, with the help of the 18 Local Centres, be able to chalk out a programme of work for this purpose.

I am glad to inform the members that should we organize evening classes in the engineering colleges and polytechnics all over India to prepare our Student members for our examinations, the Ministry of Scientific Research and Cultural Affairs is agreeable to give financial help for the purpose.

I might summarise what I have said :

1. It was important what the actual criteria were that allowed a person to commence his professional practice as a member of the Institution, but it is more important to encourage that person in pursuing studies during the whole of his professional career.

2. Education of the engineer in engineering institutions must stress the fundamentals and be strongly oriented toward the sciences without somehow losing the bias towards engineering. The engineer of the future must continue his education as a lifelong process and not end it with the completion of his formal education.

In the developed countries, there is a ferment at the undergraduate level caused by the need to increase the scientific and mathematical content of the various curricula and the consequent squeezing or elimination of certain traditional skill courses. The consensus of opinion is that this trend will continue, and the responsibility for the practical training would be shifted more and more on to the shoulders of industry.

To fulfil that task, the universities and the engineering institutions will be well advised to seek the active help and collaboration of the practising engineers.

of refresher education and training will eventually have to be introduced to improve the quality and standards in the profession of engineering. This, to my mind, is one of the major tasks before this Institution.

To the professional engineer engaged in teaching, a problem which seems to defy solution is that of giving the student some acquaintance with the rapidly growing fund of knowledge in the field of technology, within the strictly limited time available, without on the one hand becoming merely superficial and on the other narrowly specialized. One ideal which is mistaken in my view is the supposition that a degree course must cover everything in one major branch of engineering, say, everything in mechanical engineering or everything in electrical engineering. In my view, it is quite useless to expect that this is possible within the time available or is even desirable. Similarly, I do not think we should regard the frontiers between these main divisions as being sacrosanct in any way. They are where they are, largely from historical reasons, which have little validity today. For example, I believe that a first rate undergraduate course can be designed round the group of studies which are relevant to both electrical and mechanical engineering and which form the frontier region between them. In this connection, it is significant that in those countries which have separate professional Institutions serving the main branches of engineering, as in the United Kingdom, there is now a discernible tendency among them to draw closer together in educational matters. The successful introduction of the so-called Common Part I Examination a few years ago is only one example of this tendency. Perhaps the conception on which they ought to be working in the next ten or twenty years is that of a single society to which all professional engineers can belong. Such a society might by that time need anything from twenty to fifty divisions to cater for the needs of everyone, though of course many of these divisions would have a great deal of common ground with one another.

We must recognize the fact that only a well-informed man can be a well-informed engineer, and that this will not come about unless we take deliberate steps within our educational provisions to make it so. By educational provisions I do not mean merely our teaching institutions, I include also the domain of engineering employment. I fear that too often we regard these two spheres as separate and distinct and not as component parts of a single, continuous educational process. Unfortunately, I have noticed that during the last four or five years, the Governments, the universities, and the engineering institutions established by statute, not only do not approach the Institution for assessing and recognizing their degrees, but they do not even think it worthwhile to seek the advice of the experienced men of the profession. They think of the members on the staff of the educational institutions only as engineering teachers and of the others as practising engineers. They seldom, if ever, think of the latter as teachers, though in fact they have a vital educational role to play—that of helping to transform young men who have been taught the basic principles of engineering and whose minds have been attuned to engineering, into real engineers.

Be that as it may, the senior members of this Institution should seek deliberately and systematically to teach the newcomers what they themselves have learnt in the sphere of engineering practice. This will be a real contribution to the formation of the question of quality—how people could be provided with the competence to deal effectively with a range of technical knowledge which grows at an ever-increasing rate, and how it could be ensured that in increasing the number of professionally qualified people intellectual standards are not debased.

Of course, the problem either of quantity or of quality is not peculiar to the field of engineering. It is in the nature of modern society that it demands not only larger and larger numbers in the established professions, but also the recruitment for a large number of entirely new occupations calling for professional standards, some of them in the field of administration, some in that of the social sciences, others in the world of finance and commerce, and so on. We in the engineering profession, however, are in a special position in this matter. We have an almost unique experience of the problems which arise in establishing the standards and methods of a new profession, the background of which is in part scientific, in part administrative, a unique experience also in educating men to take their places in the large and complex organizations on which our society increasingly depends. Our solutions to the problems of quality and quantity, if indeed we find any, can be applied in fields of work which on the face of it seem rather remote from engineering, and so any success that we may achieve will have an importance which would go far beyond our own immediate concern.

Our Institution—University Colleges

In almost all the countries, the criterion of professional recognition is graduation from an engineering college or the passing of some other equivalent examination. As regards practical training required for professional recognition, there are countries where no such condition seems to exist still. In countries where a certain amount of practical training is required to qualify as a professional engineer, there is a great variation in the length of the period—from 16 weeks in the Netherlands to 7 years in the United States. And only in the United Kingdom and the United States are both academic degrees and practical experience fully taken into account for official recognition of professional engineers. And the title of professional engineer once awarded, remains valid for life.

The requirements for professional recognition as set out by the Institution are characterised by a legal and static approach, and do not take account of the necessity of keeping in touch with current developments and maintaining the proficiency of each member at his highest level during his whole career. This static view, which was natural in the nineteenth century when the professional careers were shorter and the process of technological change very much slower, is to my mind outmoded.

In view of the very rapid speed in which technological changes take place now, it is becoming clear that the knowledge obtained by an engineer during the period of his formal education is insufficient for the purposes of his whole career. The time has indeed come to recognize the necessity for continuous education throughout the career of the engineer. Until recently, the professional engineer was generally able to keep up with contemporary developments by private reading and attendance at occasional lectures. This is now becoming patently insufficient in view of the speed of development in innumerable fields of specialization. And so a well-thought-out system

To take the difference in the attitudes and views of the students and teachers as real would no doubt be a folly. And to expect that students must come to adopt the same attitudes as their teachers cherish, no matter how much the world has changed in the intervening period between the formative period in the life of the teacher and the present, would amount to a blunder. Such a desire results from the rigidity of our views, for it is a common human tendency to live in a static world unmindful of social dynamics.

This common failing, namely, that of losing sight of the human aspect of things, is revealed in another sphere of our national life. India since independence, has been in the throes of a struggle attempting to evolve a new world out of a world that had languished in the morass of slavery. The process cannot be a very clean one and any criticism based on time-honoured moral standards would not take us very far. Before independence, our own failures and shortcomings were ascribed to the exigencies of foreign rule, and now after sixteen years of self-rule, we are prone to lay the blame at the doors of the powers that be. No useful purpose can, however, be served by a recital of the too-patent charges. It would be more realistic to take an unsophisticated stand on the simple principle 'to err is human' and to bring in a little more of indulgence and human fellow-feeling. In our zeal for technocracy, we often lose sight of the human aspect of things and sink deeper into complications and get caught, so to say, in the spider's web out of which we are unable to emerge to meet the challenge of life.

This is true not only in the sphere of our relation with the students but also in the realm of our contact with others.

'आत्मानम् विद्धि' ('Know thyself') enjoins our philosophy. Although it is difficult of attainment, and probably it is not possible to know oneself fully, yet all the same I feel that one can reasonably try to estimate one's own limitations. Once we are in possession of this amount of self-knowledge, it would be possible for us to place ourselves in the position of others. While impatience with the viewpoint of others leads to misunderstanding, the zeal for self-criticism often hinders progress. The latter is very much in evidence in our present national emergency. It is admitted that we have overlooked an important aspect of our international relations which has caused a good deal of damage and loss to our country. But instead of dissipating our energy in trying to apportion blame in a situation of emergency, we should in the first place decide on the course of immediate action relegating the issue of fixing the responsibility of failure as a mere corollary to the proposition.

In building up a new India, particularly in this period of emergency, we are all faced with the same problems in our work of trying to provide men and women with the knowledge and skill that would go to meet the ever-increasing requirements of modern industry. It would be perhaps better if we classify these problems. We may divide them into two classes: first, those which primarily involve quantitative questions such as the number of engineers with qualifications of various kinds required on the one hand to meet the needs of expanding industry and on the other for the defence of the country, the ways and means of recruitment, and the most efficient and economical methods of arranging for their education. The second class is that of problems involving the

PRESIDENTIAL ADDRESS

'I thank you all for electing me President of our Institution. This is a very high honour indeed, in fact the highest that can be bestowed on one belonging to our profession. Honour, however, entails responsibility, and the recipient, therefore, inevitably, has an obligation to discharge. He has to set himself an objective the attainment of which, or at least his endeavour to attain it, will further the cause of the Institution. I do not know what I shall be able to do. All that I can humbly submit now is that I shall strive to live up to the confidence you have placed in me and that in the performance of my task I look upon the co-operation and goodwill of my colleagues in the Council. It is the concerted effort of all and team-spirit which will lead us to the desired goal.

It has been the practice in the past for the Presidents to deliver a very learned discourse on different aspects of engineering practice in the public and private sectors and to comment on procedure and control in the execution of projects. Criticism of administration relating to service conditions has also been a subject discussed from this Chair.

I am not in a position to follow the example of my predecessors, most of whom occupied the highest positions in the field of engineering service, and had the privilege and opportunity of executing or guiding the execution of projects of far-reaching importance and benefit to our country. My position in this plane has been mostly that of an occasional observer—one who caught glimpses of great things but never had a hand in shaping them. Although during the past few years I have had some opportunity of coming in close contact with what is known as 'administrative machinery' in the public sector, I do not consider myself competent to comment on their working. Candidly speaking, I have often wondered at the complex nature of administration and marvelled at any work being brought to completion through the maze of a myriad rules and regulations. I shall therefore confine myself to making certain observations on the tasks and problems facing the Institution, professional engineers, and Student members.

As I have spent the major portion of my life with students in general and with engineering students in particular, my approach to these questions is always from the teacher-student point of view. I use this compound word advisedly even though I realise that this is unorthodox. To those who believe that students and teachers have at least different, if not antagonistic, interests, hyphenating these two categories would certainly appear to be meaningless confusion. I am aware that such persons are not rare, only I shall hope that there are not many in our Institution. It is a fact that teachers and students belong to two different generations, and it is proverbial that youth and age do not look at the world with the same eyes. But can we never forget that teachers and students both have the same end in view? One has come to learn and the other is there to impart that learning. They are engaged in the same process, each doing his part but contributing to the same result. Their points of view might appear on the surface to be different, but the basic objective of both is bound to remain always the same.

Dr. T. Sen
President
1962-63

conclusion of the Inaugural Session at Rabindra Kalakshetra on the forenoon of May 19, 1963.

Lecture by Maj.-Gen. Harkirat Singh

A special lecture was delivered by Maj.-Gen. Harkirat Singh, Immediate Past-President, on 'Engineering in the Army' at Rabindra Kalakshetra on the afternoon of May 19, 1963.

Popular Lecture by Prof. M. V. Deshpande

A popular lecure on 'The Sixth World Power Conference in Australia, October 1962' was delivered by Prof. M. V. Deshpande (*M.*) Professor and Head of the Department of Electrical Engineering, College of Engineering, Poona, and Chairman of the Electrical Engineering Division, at the Puttanna Chetty Town Hall on the afternoon of May 20, 1963.

'At Home' by the Chief Minister of Mysore

The Chief Minister of Mysore, Shri S. Nijalingappa, was 'At Home' to the delegates in the grounds of the Residency on the evening of May 20, 1963.

Cultural Shows

Two Cultural Shows were arranged by the Mysore Centre at Rabindra Kalakshetra on the evenings of May 20 and 21, 1963. The performances were well attended.

'At Home' by the Mysore Centre

The Mysore Centre was 'At Home' to the delegates in the grounds of the new Institution building at 3 Vidhana Veedhi on the evening of May 21, 1963.

Local visits

The delegates were taken on many local visits and tours of inspection. Among the places visited were: the Indian Telephone Industries, Hindusthan Aircraft Ltd., the 515 Army Base Workshops, Sir M. Visvesvaraya Industrial Museum, and the United Breweries. Lunches or teas were given to the delegates by the various firms and authorities.

Study tours

Four study tours were arranged at the conclusion of the Session. These were:

Tour no. 1(a): Bhadra Reservoir Project; Mysore Iron and Steel Works and Paper Mills, Bhadravati; Linganamukki and Talakalale dams and power station, Jog Falls.

Tour no. 1(b): Linganamukki and Talakalale dams and power station, Jog Falls; Mysore Iron and Steel Works and Paper Mills, Bhadravati; Bhadra Reservoir Project.

Tour no. 2: Tungabhadra Steel Products; Humpi Ruins, Vijayanagar; Tungabhadra Dam; Mysore Kirloskars Ltd., Harihar.

Tour no. 3: Shimsha dam and power station; Somanathapura Temple; Bandipur Wild Life Sanctuary; Krishnarajasagar Research Station and dam; Brindavan Gardens; Mysore.

Tour no. 4: Srirangapatna; Mysore; Krishnarajasagar Research Station and dam; Brindavan Gardens; Belur and Halebid Temples; Sravanabelagola.

The delegates left Bangalore on May 23, 1963. They returned to Bangalore on May 25 or 26, and dispersed to their respective home stations.

7. 'Studies Connected with Quality of Water' by B. L. Gupta (Uttar Pradesh)
8. 'Fibre Optics' by L. S. Solanki (Madhya Pradesh)
9. 'Energy Dissipation Below Hydraulic Structures by Hydraulic Jump' by M. K. Naidu (Andhra Pradesh)
10. 'Necessity and Importance of Practical Training and Manual Work in the Curricula of Engineering Studies in India' by V. K. Ravindran (Mysore)

Out of the above paper no. 9 was not presented. Papers nos. 2 and 4 were introduced by Shri B. Nagaraja Rao on behalf the authors who were not present, and paper no. 8 similarly by Shri B. N. Sampathkumaran. The other papers were introduced by their authors. The Chairman selected a panel of judges to assist him in the selection of papers for award of prizes consisting of Prof. B. R. Narayana Iyengar (*M.*), Prof. K. Seetaramaiah (*M.*), Sarvashri B. Seshadri (*M.*) and B. R. Subramanyam (*A.M.*). He announced that the prizes that would be awarded would be in the form of books to the winners of the awards and related to the subject of their papers.

The papers were then presented and discussed.

During the meeting, the President, Dr. Sen, arrived at the Hall, and at the request of the Chairman, addressed the Students. The Chairman expressed his thanks to the President for the inspiring advice he had given them. Dr. Sen thereupon left the meeting.

The Chairman also invited Shri S. Bandopadhyaya, Vice-President and Chairman, Bengal Centre, to speak to the Students. Shri Bandopadhyaya addressed the Students and gave them valuable advice. The Chairman thanked him on behalf of the Students.

At the conclusion of the technical session, the Chairman and his panel of judges discussed the merits of the various papers and awarded three prizes in the following order:

First Prize	...	'Design of D.C. to D.C. Push-Pull Converters' by Shri B. Nagaraja Rao
Second Prize	..	'Some Improvements in Electric Traction Control (Bombay Suburban Section)' by Shri P. N. Shetty
Third Prize	..	'Coal Ash—an Economical Building Material' by Shri Shaik Mahboob

The Chairman then announced these awards and congratulated the winners. He also thanked the Students who presented the other papers.

In conclusion, he thanked the President, Dr. Sen, and the Vice-President, Shri Bandopadhyaya, for addressing the Students, and Shri Nagaraja Rao for the excellent manner in which he had organized the Students Session. He wished the Students of the Mysore Centre Students Chapter every success in their future activities.

Sixth Sir M. Visvesvaraya Lecture

The Sixth Sir M. Visvesvaraya Lecture* was delivered by Dr. A. N. Khosla, Governor of Orissa, on 'Orissa's Decade of Destiny—a Plan for the Integrated Development of the River Basins of Orissa,' following the Tea given to Dr. Khosla at the

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* The Lecture will be printed in a subsequent issue of the *Bulletin*.

Students' Session

The Students' Session was held in two parts, on May 18 and May 21. The Session commenced on Saturday, May 18, 1963, at the Puttanna Chetty Town Hall, Bangalore. Shri J. Datt (*M.*), a senior member of the Council, was in the Chair. The Chairman of the Mysore Centre Student Chapter, Shri B. Nagaraja Rao, welcomed the Chairman, the Students, and other members present to the Session. The Session was attended by Dr. Sen, President-Elect, and Shri B. Seshadri, Secretary.

The Chairman introduced the President-Elect, Dr. Sen, particularly to the gathered Students. He then called upon the Secretaries of the various Student Chapters who were present to offer any suggestions they may have in regard to the activities of the Students. The Secretaries of the Mysore, Kerala and Nagpur Centres Students Chapters then spoke on some of the problems of the Students and offered some suggestions.

The Chairman then invited the senior members present to give their views, and Prof. N. S. Govinda Rao (*M.*), Shri Dinesh Mohan (*M.*), Shri S. Varadaraja Sarma (*M.*) and Shri P. Krishnaswami (*A.M.*) took part. Concluding the first part of the Session, the Chairman suggested that any resolutions the Students wished to move may be properly drafted and presented at the second session. The Session was adjourned to the morning of Tuesday, May 21, 1963, at the United Missions School Hall.

The second part of the Students' Session, which was the technical session, was held at the United Missions School Hall at 9.00 a.m. on Tuesday, May 21, 1963. The Chairman of the Mysore Centre Student Chapter, Shri Nagaraja Rao, said that a similar meeting of his Chapter had been held in the previous year when a technical essay writing competition on 'Necessity and Importance of Practical Training and Manual Work in the Curricula of Engineering Studies in India' was arranged. The recipients of the prizes awarded for the winning essays were Shri B. N. Jayaram and Shri B. N. Sampathkumaran. He also said that his Chapter paid special attention to technical meetings of Students amongst other activities.

Ten papers were scheduled to be presented, as follows :

1. 'Coal Ash—An Economical Building Material' by Shaikh Mahboob (Andhra Pradesh)
2. 'Piezo-Electricity in Precision Measurements' by T. R. Venkataraman (Poona)
3. 'Design of D.C. to D.C. Push-Pull Converters' by B. Nagaraja Rao (Mysore)
4. 'The Construction of Concrete Plug at No. 8 Pit Shaft of (North) Loyabad Colliery' by C. R. Mukherjee (Bihar)
5. 'Parking Meters for Our Cities' by B. N. Jayaram (Mysore)
6. 'Some Improvements in Electric Traction Control (Bombay Suburban Section)' by P. N. Shetty (Bombay)

I have to extend our thanks to the Chief Minister of Mysore, Shri S. Nijalingappa, for his very pleasant 'At Home' at the Residency on the 20th May.

As this is the Closing Session, I must also record our thanks in advance to the Mysore Centre for the 'At Home' which is going to immediately follow this Session in the grounds of the new building of the Centre. Here I must express the grateful thanks of the Institution to the Government of Mysore for their munificence in the grant of free land to the Centre and Rs. 1 lakh for the building. These made it possible for the construction to be taken up and nearly completed in a very short time.

I am sure all of you enjoyed the Cultural Show last evening, when I was unable to be present owing to another engagement. I am equally sure we are going to enjoy the second Cultural Show this evening.

A number of local visits have been arranged during the Convention, and on your behalf I must express our thanks to the managements of the Indian Telephone Industries, Hindusthan Aircraft Ltd., the Hindusthan Machine Tools Ltd., the 515 Base Workshops, the Inspectorate of Electronic Equipment, and the United Breweries Ltd. for their courtesy in making the visits possible and for the lunches and teas arranged during the visits.

During the outstation visits which will commence tomorrow, many facilities for the visiting delegates will be extended by various Departments of the Government of Mysore, the Mysore State Electricity Board, the Mysore Iron and Steel Works, the Mysore Paper Mills, the Krishnarajasagar Research Station, and the Tungabhadra Steel Project. I would also like to thank them in advance for these courtesies'.

With a vote of thanks to the Chair, the Session concluded at 5.30 p.m.

Special and other events

Annual Dinner

The Forty-third Annual Dinner of the Institution was held on Sunday, May 19, 1963, at the Glass House, Lalbagh, Bangalore. Dr. A. N. Khosla, Governor of Orissa, was the Chief Guest. A distinguished guest was Shri S. Nijalingappa, Chief Minister of Mysore. Many guests and over 400 members attended the Dinner.

After dinner, the President, Dr. T. Sen, requested the guests and members to rise and drink a Toast to the President and the Republic of India.

The President, Dr. Sen, also proposed a Toast to Chief Guest. Dr. Khosla replied to the toast.

Shri B. R. Manickam, Chairman, Mysore Centre, proposed a Toast to 'Our Guests'. Shri Nijalingappa replied to the toast on behalf of the guests.

A Toast to 'Ladies' was proposed by Dr. M. S. Thacker, Past-President. Shrimati J. G. Bodhe, wife of Shri J. G. Bodhe, Vice-President and Chairman of the Bombay Centre, replied on behalf of the ladies.

Finally, a Toast to the Institution was proposed by Prof. S. Dhawan, Director, Indian Institute of Science, Bangalore. Maj.-Gen. Harkirat Singh, Immediate Past-President, replied on behalf of the Institution.

In conclusion, he placed the following resolutions adopted at the Students' Session before the President:

(1) Technical Film Library: The effort of the Head Office of the Institution in arranging for a technical film library was very much appreciated. It is hoped that the arrangement will be completed early and the various Students Chapters would be in a position to utilize this library to the best interests of their members.

(2) Finance: *Resolved* that to organize the activities of Students Chapters the Council be requested to be more liberal in the allocation of grants up to a maximum of Rs. 1,000 for any Local Centre having two or more Students Chapters, as and when the activities warrant.

(3) Examination: *Resolved* that for Students securing exemptions in at least one paper of the Section A or the Section B examination under the old scheme of examinations by November 1963, the Examinations Committee and the Council be requested to extend the time limit for the old scheme now set at November 1964 for completing the Section by a further year.

(4) Recognition of passing Sections A and B Examination of the Institution by various State Governments: *Resolved* that the Institution should take up the matter or recognition of the passing of Sections A and B of the Associate Membership Examination as equivalent to the passing of the engineering degree examination with the Government of Maharashtra and other State Governments where such recognition has not so far been granted.

The President put Resolutions (2), (3) and (4) to the Corporate Members. These were adopted unanimously.

The President concluded as follows:

'I have now the very pleasant duty of extending our warmest thanks to the Mysore Centre for acting as hosts on this occasion and for their unbounded hospitality during the last few days. I wish particularly to mention the names of Shri Veerendra Patil, Minister for Public Works and Chairman of the Reception Committee, Shri B. R. Manickam, Chairman of the Mysore Centre, Shri R. A. Rajagopal, Honorary Secretary, and Shri S. G. Ramchandra, Joint Honorary Secretary, in this connection.

The work of organising the Convention proceeded under the inspiration and guidance of Shri Manickam. The two Honorary Secretaries have worked with unflagging zeal over a period of many months to make all these extensive arrangements. They were handicapped by the postponement of the Convention from February to May, but, as you will all agree, they have overcome all obstacles to make this Convention an outstanding success.

Our thanks are also due to the members of the Committee of the Mysore Centre, the members of the various Sub-Committees who were responsible for organising the technical sessions, transport, local visits, outstation tours, etc.

I should also mention the Student volunteers who have been everywhere attending to the many details of the arrangements.

Gammon (India) Ltd., had announced a prize for the best paper on shell structures published in the *Journal* during each year. The Council may get in touch with him to organize this prize. (*Applause*); (2) At the last meeting of the Executive Council of the International Association for Shell Structures, of which the Chairman was a member, held at San Francisco in October 1962, it was resolved that a Conference of the I.A.S.S. may be held in India some time in 1965. The Group would like to request the Institution to co-sponsor the Conference. The details would be passed on to the President by the Chairman in due course; and (3) The Group, together with Structures Group 1, endorsed the resolutions already read out by the Chairman of that Group.

The President then put the resolutions to the Corporate Members. They were adopted unanimously.

(xi) Shri J. Datt (*M.*) who took the Chair at the Students Session reported on the proceedings of the session.

He said the Students held the first session on 18th May. On the invitation of the Chairman, the Secretaries of the Mysore, Kerala and Nagpur Centres Students Chapters spoke on some of the problems of the Students and offered some suggestions. The Chairman also invited senior members to give their views, and a few members took part. Concluding the first part of the session, he suggested that any resolutions the Students wished to move may be properly drafted, and presented at the second session.

The second part which was the technical session was held on 21st May. Ten papers were scheduled for discussion, nine were actually presented, and three prizes were were proposed to be awarded for the best papers. The Chairman selected a panel of judges to assist him, consisting of Prof. B. R. Narayana Iyengar (*M.*), Prof. K. Seetharamaiah (*M.*), and Sarvashri B. Seshadri (*M.*) and B. R. Subramanyam (*A.M.*). The following papers were awarded prizes in this order: (1). First Prize—'Design of D.C. to D.C. Push-Pull Converters' by Shri B. Nagaraja Rao; (2) Second, Prize—'Some Improvements in Electric Traction Control (Bombay Suburban Section), by Shri P. N. Shetty; and (3) Third Prize—'Coal Ash—an Economical Building Material' by Shaik Mahboob.

The Chairman asked the President to present the prizes, which were in the form of books selected in the fields of interest to the winners. The President then distributed the prizes.

The Chairman then said that both the President and Shri S. Bandopadhyaya (*M.*), Chairman, Bengal Centre, had addressed the Students and given them encouragement.

There was a general feeling that sufficient attention had not been paid to bring into focus the activities of the Students Chapters, and the Students Session, although announced in the programme printed in the *Bulletin*, did not find a mention in the locally printed programme. This was a matter which demanded earnest consideration as it was the Students of today who would be the engineers of tomorrow, and nourishing them into worthwhile stature was one of the Institution's prime functions.

He congratulated the authors of the papers and paid a special tribute to Shri Nagaraja Rao who had so successfully arranged the Students Session.

Engineering Division was meeting simultaneously. In his Address, the Chairman described the recent advances in prestressed concrete and reported on the Fourth Congress on Prestressed Concrete which he had attended.

One paper on 'Stress Corrosion and Use of Calcium Chloride' by Dr. C. K. Ramesh (*Non-member*) was presented. There was good discussion on it. Members present also discussed the application of prestressed concrete in India both in design and construction and in research. It was noted that next to the United States India was the largest constructor in prestressed concrete. Discussion also took place on the ways and means of increasing the activities of Structures Groups 1 and 2, and the two Groups jointly adopted the following two resolutions :

1. *Resolved* that in view of the important role of Structural Engineering as a specialized branch of Civil Engineering, all the activities in Structural Engineering including acceptance and discussion of papers shall be entrusted to Structures Groups 1 and 2. Both Groups will, however, continue to be limbs of the Civil Engineering Division and work under the general supervision of the Chairman of that Division. As Structural Engineering itself covers a vast and diversified field, it can effectively function only if it is organized under two Groups as at present with the division of responsibilities noted as follows: Group 1: Design and Construction, Concrete Technology, Reinforced Concrete, Prestressed Concrete, and Steel Structures including Their Methods of Construction; and Group 2: Structural Analysis, Structural Theory, Applied Mechanics, Shell and Space Structures, Digital Computation, and Experimental Stress Analysis.

2. *Resolved* that as structural engineers are basically civil engineers, it is essential that sessions of the Civil Engineering Division and of Structures Groups 1 and 2 should not be arranged concurrently as members of the two Groups would like to participate in the discussions of papers in the Civil Engineering Division also.

Fédération Internationale de la Précontrainte of which our Institution was a member had suggested certain topics in prestressed concrete on which technical papers or conclusions after holding symposia should be sent to them as this country's contribution for the next international Congress that may be held in two or three years time. The Group has selected the following two subjects for the next year: (1) Prefabrication, and (2) Prestressed Concrete for Machinery Foundations and Furnace.

(x) Shri G. S. Ramaswamy (*M.*), Chairman, Structures Group 2—Shell Structures, said that the proceedings in his Group commenced with the Address by the Chairman. The Address surveyed and summed up some of the recent trends and activities in this field in India and abroad. He gave a first-hand account of the World Conference on Shells held at San Francisco last year in which he had the privilege of being one of the Chairman.

Three papers were then presented and discussed. The first two papers were analytical in nature. The third paper reported an experimental investigation on a continuous cylindrical shell.

The following decisions taken at the meeting of the Group required the attention of the Council: (1) On an appeal from the Chairman, Shri T. N. Subba Rao, of

The following 6 resolutions were adopted by the Division:

1. *Resolved* that the Public Health Engineering Division puts on record their sincere thanks to the Past-President of the Institution, Maj.-Harkirat Singh, and to the Secretariat for their prompt action in getting the status of a Division to the erstwhile Public Health Engineering Group and in providing the necessary forum to the Division by the establishment of three issues of the *Journal* per year.

2. *Resolved* that the Public Health Engineering Division notes with deep concern that the specialized branch of Public Health Engineering has been left out from the All-India Service of Engineers. It feels strongly that this would come in the way of attracting in sufficient numbers bright and capable engineers to this important field of engineering. It strongly recommends that the Institution take up the matter with the Government of India and get this important branch put in line with other branches, *viz.*, Buildings, Roads, Irrigation, etc.

3. *Resolved* that the Public Health Engineering Division puts on record its appreciation of the work done by the Committee for the publication of newsletters. It further recommends that to start with five operating brochures be issued on the following subjects which could be useful to engineers and plant operators in English, Hindi, and any other regional languages deemed necessary: (i) Minimum acceptable standards for drinking water; (ii) Methods of chlorination of urban water supplies; (iii) Coagulation of water supplies; (iv) Laboratory tests; and (v) Minimum tests for sewage plant effluents standards.

4. *Resolved* that the Public Health Engineering Division expresses its keen interest in the International Conference on Water Pollution Research to be held in Tokyo in August 1964 and lends its wholehearted support by sponsoring this Conference on behalf of the Institution of Engineers (India), together with Central Public Health Engineering Research Institute. It also commends to the Central Public Health Engineering Organization of the Ministry of Health to join in this sponsorship. It requests the members to send papers to the Steering Committee at the earliest and their active interest and participation in this Conference in view of the serious problems of water conservation and stream pollution facing India.

5. *Resolved* that the Public Health Engineering Division welcomes the Symposia on (i) 'Public Health Engineering Education', and (ii) 'Oxidation Ponds for Sewage Treatment' to be arranged in Nagpur in October 1963. It expresses its desire to participate in these Symposia and be a co-sponsor with the Central Public Health Engineering Research Institute.

6. The Public Health Engineering Division strongly recommends to the Ministry of Health to restart the convening of yearly State Public Health Engineering Conferences where all-India problems of public health engineering can be discussed and tackled most expeditiously.

The President then put resolutions 2, 4 and 6 to the Corporate Members. They were adopted unanimously.

(ix) Shri N. N. Purandare (*M.*), Chairman, Structures Group 1—Prestressed Concrete, said that attendance at the Group meeting was good even though the Civil

(vii) Dr. A. K. Chatterjee (*M.*), Chairman, Electronics and Telecommunication Engineering Division, said that the Division commenced its proceedings with the Chairman's Address. Then six papers were presented and discussed. There was a very informative paper on telecommunication networks on Indian Railways.

He observed that although a fair number of papers were being published in the *Journal* Part pertaining to his Division, most of them came from non-members. These people although working in the telecommunication engineering field were not able to join the Institution as members for want of an admission qualification acceptable to the Institution. He suggested this matter may be looked into by the Council.

The President told Dr. Chatterjee that he would be glad to have this question examined.

(viii) Shri R. S. Mehta (*M.*), Chairman, Public Health Engineering Division, said that he would first of all like to thank the outgoing President and the Secretariat for their help they had given in raising the Public Health Engineering Group to a Division. He said that his Division met as a Division for the first time, and attendance was very good as usual, and included distinguished public health engineers from abroad.

The Chairman in his Address reviewed the activities of the Public Health Engineering Division during the past year and emphasized on the following points. Public Health Engineering included not only problems of water supply and drainage but also those of industrial wastes disposal and recovery, air pollution, radiological health, industrial hygiene, public health aspect of housing, and food sanitation. Due to the Chinese invasion of the country, problems of sanitation and water supply at very high altitudes had also come up. These problems deserved the immediate attention of public health engineers and their concentrated research effort for finding solutions.

The Chairman continued that the action on the part of the World Health Organization and the Ministry of Health, Government of India, in setting up standards for drinking water was very welcome. He emphasized the need for research on water pollution control as the problem of prevention of pollution of rivers in the country had gained much importance. He stressed the need of Indian participation in the forthcoming international conference to be held in Tokyo. He highlighted the problems of conservation of water resources and water pollution control, and said indications were good that more interest was being taken in the vital problem of diseases prevention as against the curative side.

The Division was addressed by Prof. Luis F. Mantilla, Environmental Health Regional Adviser, W.H.O., New Delhi. He described the work that was being done in the South American countries in public health engineering with particular reference to the assistance given by the W.H.O.

Prof. M. J. Willis from the University of Wisconsin, U.S.A., explained the work that was being done in the University of Roorkee in the field of public health engineering under his guidance.

Four papers were discussed in the paper meetings, and the discussion was active. The subjects covered design of sewers, methods of water analysis, sewage treatment, and radioactive wastes treatment.

Four papers were discussed in the paper meetings. These were: (i) 'Design of Electrical Power Machines' by Shri S. H. Raj; (ii) 'Possible Criteria for Determining the Condition of Lightning Arresters' by Sarvashri V. Prabhashanker (*Non-member*) S. S. Hubli (*Non-member*) and Prof. D. J. Badkas (*A.M.*); (iii) 'Predetermination of Electrical Characteristics of Steel Tubes at Power Frequencies' by Dr. H. R. Chablani (*A.M.*); and (iv) 'Some Research Problems in Electrical Apparatus' by Prof. M. V. Deshpande (*M.*).

In the fourth paper, the author suggested a number of problems for research and investigation at post-graduate level in the universities as well as in industry. The problems were broadly divided into three groups: design, analysis and measurement.

A Symposium on 'Analogies in Engineering' was then held which brought out the methods of using electrical analogy for solving a number of engineering problems in, for example, hydraulics, vibration, design of electrical machines, and many others. Five papers were presented and discussed. The discussion which followed was well informed and instructive.

(iv) Shri R. N. Joshi (*M.*), Chairman, General Engineering Division, said that proceedings in his Division started with the Chairman's Address. This was followed by paper meetings, when the papers listed in the programme were discussed.

A Symposium on 'Some Aspects of Engineering Education' was held, in which a number of very useful papers were presented. Problems such as whether or not we need more engineering colleges, student aptitudes for engineering, desirability of assessment of term-work, and the need for some reorientation of engineering eduction in view of the national emergency such as giving it a military bias, were discussed. The discussions were both substantial and informative.

(v) In the absence of Shri R. M. Patri (*M.*), Chairman, Industrial Engineering Group, the proceedings in this Group were conducted by Shri R. N. Joshi (*M.*), who reported briefly.

Four papers were presented as announced in the programme, and there was useful discussion.

(vi) Dr. V. M. Dokras (*M.*), Chairman, Chemical Engineering Division, said that the Chairman in his Address stressed the need for flexibility in determining the content and structure of various technical courses, keeping especially in mind the need for providing training at various levels from purely scientific to purely engineering, as the need for knowledge of both was required to make a success nowadays. He pointed out that at present times problems of fundamental inveaigation are often problems of engineering and *vice versa.*

He said that the following four papers were presented and discussed at the paper meetings: (i) 'Adiabatic Extrusion of Thermoplastics' by Prof. M. V. Joshi (*A.M.*) and Shri K. A. T. Varghese (*Non-member*); (ii) 'Study of Primary Air Entrainment in Gas Jet Burners' by Mr. G. S. Davies (*Non-member*) and Shri S. G. Mukherjee (*Non-member*); (iii) 'Introduction of Two Basic Factors (Q_b and T_d) in the Design of Combustion Furnaces' by Shri A. K. Shaha (*M.*); and (iv) 'Utilization of Lignite Fly Ash from the 400 MW Thermal Station at Neyveli' by Dr. C. V. S. Ratnam (*A.M.*) and his co-workers. There was considerable discussion on the first and the last papers.

The Chairman in his Address spoke of the advances made in other countries in the manufacture of hydraulic machines like pumps and turbines, and other structures like high pressure gates, tunnels, conduits, etc. If similar advances have to be made in this country, it was necessary that facilities should be created for advanced research in cavitation, turbulence, and other fields in fluid mechanics.

In the Symposium on 'Engineering Construction and Materials' and the paper meetings that followed, the following deserved mention :

It was felt that increasing use of mathematical models with the use of digital computers and/or analogue computers should be made in the studies of hydraulic problems.

There was very useful discussion on the design and construction of a chimney of 400 ft. high, which was probably the highest in Asia.

It was recommended that increasing use of modern materials like plastics, industrial wastes like fly ash, furnace slags, etc. should be made. For this purpose and also to see that the latest methods are applied to design of structures, design and extension work cells should be created in all chief engineers' offices, and in architects and consulting engineers' offices. It should be the duty of these cells to keep themselves continuously informed of the latest design methods, and the materials coming on the market, and spread the information to others in the profession.

Planning cells were also necessary to prepare master plans of engineering development such as utilization of river waters for irrigation and power development, planning highways, town planning, etc. These master plans should cover both the immediate and long-term needs of the country, and also study the socio-economic benefits generated as a result of engineering development.

It was also felt that for planning, design and execution of major projects under the public sector, the best men who have managerial experience should be selected as administrators. It should not be the close preserve of the civil service of the Government.

(ii) Shri S. M. Patil (*M.*) who conducted proceedings in the Mechanical Engineering Division in the absence of Shri T. R. Gupta (*M.*), Chairman of the Division, was not available, and Shri H. K. Ramanujam (*M.*) reported briefly.

He said a number of useful papers had been presented in the Symposium on 'Automation in Industry'. One of these dealt with automation in metal cutting operations, a second on automatic inspection and checking, and another on the impact of automation on productivity in light engineering industries. He said the discussion was both lively and informative.

(iii) Prof. M. V Deshpande (*M.*), Chairman, Electrical Engineering Division said that proceedings in the Electrical Engineering Division started with the Address of the Chairman. In his Address, the Chairman spoke on the latest developments in electric drives including the development of variable speed induction motors using squirrel-cage rotors. He stressed the need for starting design and research units for electrical apparatus.

required for the development of the country. On behalf of the Institution, I express our sincere thanks to our Chief Minister.

Our Public Works Minister, Shri Veerendra Patil, who welcomed you all, is a young and intelligent man with enormous will and energy. He had to follow the Union Minister on tour, but his desire to associate himself with our engineers made him request the Union Minister to postpone his tour by a day. On behalf of the Institution, I thank him most sincerely for having accepted to be the Chairman of the Reception Committee and to have undertaken the task of welcoming you.

We are very grateful to the benign Government of Mysore, who have been always generous in extending their help for the growth of this Institution. When the Mysore Centre was started, the Mysore Government gave a contribution to the members of the Mysore Engineers Association to meet the extra subscription to enable them to join as members of the Institution of Engineers. They have now granted a site in a prominent place free of cost for the construction of the Institution building. In addition, they have given a grant of one lakh of rupees towards the cost of construction. They further promised to give a substantial grant to equip our library with books that our engineers need for enriching their knowledge to serve for the development of the country. I may not be wrong if I say no other State Government has done so much for the cause of the Institution. Our sincere thanks therefore are due-to the Government of Mysore.

I hope it will not be considered as self-glorification if I mention our thanks to Major-General Harkirat Singh, our outgoing President, Dr. Sen, the incoming President, Dr. Thacker, a Past-President, and other senior members who have taken so much interest in arranging for this function to be held in Bangalore. I should also express our indebtedness to two Honorary Secretaries, Shri Rajagopal and Shri Ramchandra, who have borne the brunt of the work of organising the convention.

I do not want to take your time by individually thanking a number of organizations and persons who have helped in bringing this function to a success. In enumerating them I may commit an error by omitting some. Suffice it to say that the Institution is thankful to one and all and also to those who have assembled here, who in some capacity or other are associated in helping us to successfully carry out this function'.

The National Anthem was then played. Dr. Khosla left the meeting at 10.45 a.m. for a group photograph with the Council. A Tea was then given in his honour in the grounds of Rabindra Kalakshetra.

Closing Session, Tuesday, May 21, 1963

The Business Session of the 43rd Annual General Meeting adjourned from May 18, 1963, was held at 4.00 p.m. on May 21, 1963, at the Town Hall, Bangalore. The President, Dr. T. Sen, was in he Chair.

At the request of the President, brief reports of the technical sessions held in the various Divisions and Groups were presented by the respective Chairmen.

(i) Prof. N. S. Govinda Rao (*M.*), Chairman, Civil Engineering Division, said that the Civil Engineering Division held its meetings in three sessions.

into despair. In the long run, it is not the external aid but our own effort that will determine the fate of our prosperity and freedom. Friendly countries no doubt will—as they already have—come to our help in our hour of crisis, but there can be no substitute for self-help and self-reliance. Ultimate triumph will basically emerge from our own efforts and our own will. In this age of science and technology, the engineers and scientists constitute the main spearhead of economic advance, as also of defence. The present offers us a unique challenge and a unique opportunity. I am sure that all of us will rise to that challenge and grasp that opportunity in the service of our nation.

Jai Hind.'

10. Shri B. R. Manickam, Chairman, Mysore Centre, proposed a vote of thanks to the Chief Guest, Dr. Khosla, the Chief Minister of Mysore, Shri S. Nijalingappa, and the other guests present as follows :

'Dr. Khosla, Shri Nijalingappa, Shri Veerendra Patil, Dr. Thacker, Members of the Institution of Engineers, Ladies and Gentlemen,

It is now my proud privilege to propose a vote of thanks.

This Convention should have taken place early in February this year. We had made elaborate arrangements. The Legislature and the Government had agreed to the Session being held in the third week of February in order to accommodate our delegates in the Legislators' Home. Arrangements had been made for the delegates' tours in Mysore State. But, unfortunately, the Convention was postponed due to emergency and other reasons. The result was that there was some infructious expenditure and unexpected disappointment. Our engineers who were very enthusiastic had to abandon all arrangements made. In fact, they lost faith in my direction. The most pitiable group was the Committee of Ladies, who were anxiously waiting to welcome the visiting ladies. They left most disappointed when they were told at a last meeting that the Convention had been postponed.

Anyhow we are happy now. After all, the Convention is now being held in Bangalore. Thanks are due to the Council for their decision. We are extremely grateful to Dr. Khosla, an eminent engineer, who is now occupying the position of Governor, for having accepted to deliver the Inaugural Address today. Our Chief Minister remarked, we have also an 'engineer-Governor'. I am telling the student members that this is yet another opening to the engineers. It may be rememberd that Dr. Khosla at the last Mysore Convention held in 1951 was the outgoing President of the Institution and now he has come as a Governor to inaugurate this function. On behalf of the Institution I once again thank him sincerely.

Our revered Chief Minister of Mysore, Shri Nijalingappa, is a person with very rare and exceptional qualities. It is difficult to find a man of his type and character. Broad-hearted, farsighted, unprejudiced, with absolutely sterling qualities, he combines simplicity with magnanimity. We cannot find a more selfless and sincere person who is outspoken and straightforward. He is also our Minister for Irrigation and Power. In fact, he rejected other engagements and accepted to attend this function expressing that he would be happy to associate himself with engineers whose services are most and industry bridged. Outstanding examples of cutting down this lag and bridging this gulf are provided by the achievements at institutes like the M.I.T. and the California Institute of Technology in the U.S.A., which through sponsored research have made outstanding contributions to national defence and industry in that country.

Science and technology have placed in the hands of man unbelievable power for construction as well as for destruction. If used for construction, mankind can be rid of want and disease and live in peace and plenty. If used for destruction, whole populations can be wiped out in a matter of hours and days. In order that science and technology are applied for the furtherance of human welfare and not for its destruction, man must be given moral and spiritual advancement so as to know how to use these for construction. Science and religion are two different expressions of the human spirit; both are advancing in search for truth. Science is inadequate to its present stage of development to grasp the spiritual verities, but with the rapid pace of its advance, these verities will come closer within its grasp and then the common man may hope to have a physical demonstration of the unity of science and religion.

In the matter of technical education, top priority should be given to the selection and training of teachers. We must have the very best men to man our teaching and research posts. Economic independence and social status must, therefore, be assured to our teachers. As a matter of policy, these selected teachers must be exposed to discussions at seminars and refresher courses and given opportunities of visiting, or even working for specified periods in other high class institutions; and also encouraged to do a reasonable amount of consulting work, whereby they can progressively enrich their own knowledge and in turn transmit all that to the students.

In conclusion, I might refer to the present emergency. We all know that it is going to be a long-drawn affair and that we must fight our own battle. Nobody from outside can fight it for us. We have to strengthen our own military, industrial and agricultural base and prepare ourselves to defend the country with our own resources of men, food and industrial output and our own equipment. Battles between the armed forces of today are in essence battles of nations as a whole and on all fronts, social agricultural, industrial and economic. Development plans are, therefore, an essential part of preparation for defence. To repel the Chinese invaders—we must mobilise to the utmost our resources in men, money and materials, develop high discipline and morale, and be prepared for heavy sacrifices. Austerity living, producing more, consuming less, and conserving savings and directing all savings to help the war effort must, therefore, from now onward constitute our normal way of life for as long as the emergency lasts.

We are faced with the twin challenge of economic advance and defence. We have suffered from tradition, inertia and neglect. Now we are witnessing the throbbings of a new life. There is a definite change in our hearts and minds and a growing will to develop our country. We have now to telescope into decades, if not years, the pioneering and growth of centuries, so that in the not distant future, we may be in a position to march abreast of the more advanced nations of the world. We must proceed with our task with a sense of urgency, conviction, crusading zeal, and the will to achieve. Hope delayed maketh the heart sick. Aspirations can turn into frustration and hope human effort. There have to be right policies and the crusader's zeal in the implementation of those policies and the development of those resources, and above all there have to be engineers and scientists in adequate numbers and of high quality with the will and determination to see things through with expedition, economy and integrity. For decades, we have suffered from tradition and inertia. Signs are, however, visible that we are pulling definitely out of these two maladies. But the attitudes and character of a people do not change overnight. We have to force the pace through persuasion and policies, through legislative action and enforcement, and that has to be done on all fronts and with a sense of urgency. The entire energy of the people has to be mobilised into productive channels. This is the engineers' challenge.

Obviously, there should be no limit placed on the outturn of engineers and scientists. In this age of science and technology, there can never be over-production of scientists and engineers. The greater the number, the greater the output of ideas and productive efforts, and also the better the opportunities for picking out quality. The estimates of technical manpower prepared at the beginning of the Third Plan are already out of date. Much greater numbers, more diversified discipline, and higher attainments in science, engineering and research are the needs of the hour.

It is gratifying to note that decision has been taken to increase the number of engineering graduates, to make the teaching of science compulsory in schools, and to lay greater emphasis on post-graduate work and research; and further, in the interests of expedition and conservation of our resources in technical manpower and money, to increase admissions to well-established institutions to the maximum extent possible instead of diffusing energy and resources over setting up a large number of new institutions.

Apart from the increase in numbers, which is our first necessity, we must aim at training engineers for higher knowledge and competence with sound grounding in science and thus equip them to man our planning, design, research and construction organizations and to set up indigenous consulting services, so that we may be able to become self-sufficient in this vital service in the shortest possible time. We must build up our own expertise in every branch of engineering and research. I am sure India can achieve what other nations have done. Where there is a will, there is a way.

Our engineering curricula must have more and more of basic science content, that is, mathematics, physics and chemistry. Humanities must also constitute an essential element in such curricula, so that the engineer does not lose sight of the human side of the scientific and technological advance. There must be growing emphasis on post-graduate work and research, with a view to progressively raising the standard of teaching and research and generating in the student body a growing spirit of enquiry and experiment.

Basic research should become mainly the responsibility of the universities, applied research that of national laboratories and other laboratories in the Government departments and industry. Sponsored research must be encouraged in the universities to stimulate a broad-based attack on our problems of development and defence. The lag between discovery and its application must be cut down and the gulf between research power, industries, transport and communications account for Rs. 6,443 crores or 62%. Thus engineering activity will account for 62% of the total investment in the Third Plan. Efficiency, expedition and economy are, therefore, of vital importance. The money so saved will be available for execution of other projects of national importance. This highlights the dominant role the engineer has to play in developing the economy of the country and the grave responsibility he carries on his shoulders. Apart from aspiring to near-perfection in efficiency, expedition and economy, integrity in thought and deed must always be the core of his professional and personal ethics.

The Government of India in the Planning Commission have been devoting a good deal of thought to the question of measures for effecting economy in the construction costs of major engineering projects. As a result of prolonged deliberations, a Memorandum was prepared and printed and copies of it circulated to all State Governments and presumably also to all engineers charged or associated with the construction of projects. Various measures for effecting economies are discussed in this Memorandum. I would earnestly suggest that all engineers should study both the Symposium and the Memorandum. Among other things, the Memorandum emphazises the urgent necessity for building up of expertise so that in the matter of designs, specifications and consulting work, we may not have to took to outsiders for help; on work study as a necessary part of training of all engineers holding key positions in a project; on the preparation of comprehensive completion reports immediately after a project is completed; and the preparation and publication of technical bulletins dealing with all aspects of construction planning, construction equipment, construction layout, time schedule, delays in execution, designs and departure therefrom, difficulties encountered and how resolved, factors leading to increase or reduction in cost, and, above all, a critical analysis of innovations, mistakes made, calculated risks taken, and proposed guides for the future. This work, it has been suggested, should be undertaken while works are in progress, impressions are fresh and the designs and field staff are in a position to assist in the preparation of these bulletins.

Lastly, I would like to touch on some aspect of the engineering education. In this present age of nuclear breakthroughs and space travel and with the industrial revolution that is on us, we shall be needing engineers and scientists in unlimited numbers. No amount of planning based on the norms of yesterday and even today will give even an approximate idea of the immensity of the problem and of the number of scientists and engineers required during the Fourth, Fifth and subsequent Plans. Despite our limitation of resources, we have to move much faster than indicated by our present planning. If the pace of development is such that even at the end of the century almost a third of population will still be poor, our planning will not have served its primary objective. As it is, we are decades behind the more advanced countries in science and technology and the gap is getting wider and wider, for while the developments in science and technology are proceeding at a fantastic pace in those countries, we are yet in most cases in the thinking stage. Unless we can make a definite breakthrough in the near future, our advance will continue to be at a snail's pace, compared to the rapid strides made by the more advanced countries. How this breakthrough can be made I have yet no clear idea. There have to be resources—and resources are a direct measure of of our indigenous research will remain unproved at the field and plant level and lie buried in the record rooms. Discovery, innovation, invention and initiative will remain dormant and we will continue to be decades behind the advancing nations where idea, techniques and processes go on changing with fantastic rapidity.

Till these design institutes are set up, the hundreds and thousands of engineers and scientists now in active service can make a worthwhile contribution even with their present knowledge and training on the numerous undertakings of varying complexity presently in hand, if each one of them takes a vow to devote himself heart and soul to the execution of his assigned task, brings to bear a sense of urgency, concentrated effort, deep thinking, and a spirit of enquiry and innovation. In all scientific and technological advance, there is no substitute for thinking for one's self, for the habit of enquiry, for the drive for innovation, and for the gamble of experimentation. To go blindly after what is written in texts or handed down through practice and tradition will fail to develop one's creative potential. It will only end in traditional routine and a more or less stagnant level of performance. The creative faculty and some mental balance is inherent in every living man. If these can be stimulated and mobilized, much progress can be made towards up-to-dateness even with the quantum of knowledge and experience we have.

An engineer's main responsibility is to produce results of the best quality in the minimum time and at minimum cost. That requires full awareness of the quality, time and cost factors. An engineer has, therefore, to be a planner, organizer, designer, builder and manager. He must have full understanding of quality control, costs, and the time factor. The Institution of Engineers held a very informative Symposium in November 1961 on 'Efficiency of Engineering Enterprises in India'. This was widely attended and views were freely and frankly exchanged. These deliberations highlighted three major objectives, efficiency, expedition and economy, and put forward various suggestions to achieve these objectives through a rational and balanced project set-up, comprising engineering, finance and administration, and emphasized that in this set-up anything which militates against any of the three essential objectives must be eliminated. In the organization of a project, it is not the individual or any particular service label that should matter. What should matter is the efficiency, speed and economy of its implementation. In engineering enterprises, the key man must, of course, be the engineer, but he should be amenable to the discipline of financial and administrative ethics. The key personnel in the fields of engineering, administration and finance must work as a team, as complement to each other, each one taking decisions in his own field and the others helping him to carry out these decisions in the best interests of the projects. Bossism has been the main obstacle to harmonious working in most cases and has resulted in divorce of authority from responsibility, hesitation in assuming responsibility and taking decisions, delays in execution, and the inevitable rise in costs and delay in execution.

The bulk of expenditure on our Five-Year Plans represents and will continue to represent expenditure on engineering activities in the fields of agriculture and community development, irrigation and power, industries, transport and communications, etc.. In the Third Five-Year Plan, of the total investment of Rs. 10,300 crores, irrigation, in mounting developments and still newer ideas, newer techniques, and newer instruments. The evolution of isotopes, nuclear power plants, space ships, solar batteries, transistors, computors, etc., has been the outcome of such interplay.

Science and technology have become a decisive element in the fall or survival of our very civilization. The engineers and scientists can, therefore, faithfully discharge their social responsibility of the people only if development of pure science and technology proceeds side by side and in an integrated manner. In time of emergency, discovery and application must advance together to be of immediate use, as well as of progressive use in the long run. In such emergency, there is no time to wait for the leisurely translation of abstract ideas and discoveries into concrete achievement.

During the Second World War, which witnessed the greatest advancement in the fields of pure science and technology, the engineering and scientific research organizations had to be thoroughly overhauled in order to have quick results. Crash programmes were initiated in most countries. In America such a crash programme was initiated under the purposeful and dynamic guidance of Dr. Vannevar Bush as Director of the Wartime Office of Scientific Research and Development. Dr. Bush, a Doctor of Engineering both from Harvard and M.I.T., organised science to do the wartime job assigned to him and he made a success of it. ‘Dr. Bush fathered and guided the war science programme so well that for the first time research was put on a highly coordinated basis, the work of at least a decade was compressed into 3½ years, duplicate effort was greatly reduced. Instead of many scientists working independently in many directions towards a single solution, the problem was split, and a crew of experts, each top in his own specialized field, worked on portions of it towards a cooperative result. The research varied from jet planes and new medicines to radar and atomic energy.’

I have quoted the above passage more than once in my addresses. To my mind it stands repetition a hundred times over. It shows the way to coordinated and decisive action with a view to achieving results without loss of time. It is the lead which India should follow if it has to telescope the pioneering and growth of centuries into decades if not years. Research in India must be put on a highly coordinated basis and that without delay.

Simultaneously, there is need for setting up design institutes for all branches of specialized engineering such as structures, foundations, steel plants, refineries, petrochemicals, fertilizers, aircraft, construction equipment, heavy vehicles and their engines, etc. This is a big task and will require thousands of engineers specialized in various branches of engineering and science. Such institutes cannot be put up overnight, but a beginning must be made and that quickly and on a fairly comprehensive basis. The expenditure involved will be a fraction of what we are paying to foreign consultants, foreign knowhow, and foreign products. It will bring a thousandfold direct return. Apart from that, unless we make an earnest and determined beginning in the development and utilization of indigenous engineering and scientific effort, the indigenous content of our mammoth undertakings will remain small. Costs will continue to mount up and there will be a growing drain on our foreign exchange resources. The results projects, power plants, and industrial installations have come up during the three Five-Year Plans. Development projects on a more gigantic scale will continue to be taken up for many Plan periods ahead. Agriculture, which forms the base for all economic development and defence, is assuming overriding importance. Economic advance is inextricably linked up with defence.

In the implementation of these mammoth and vital projects, India is faced with the problems of numbers and quality of engineers, and of the lack of specialized technical knowhow which comes from high academic training in science and engineering and specialized field and plant experience. Not much headway has been made in setting up institutes for design in the various general and specialized fields, nor has there been much advance in the application of research to field problems. Because of these, for all major industrial and other projects, the services of outside agencies have to be invoked for the preparation of project reports, design, construction schedules, and even for the erection and supervision of these installations. In some cases, such recourse is under the compulsion of events, but, in others, a result of tradition and escapism.

Before independence, the type of jobs engineers in India had to handle were of a relatively-simple nature, and the resources of engineering in the British Empire for technical knowhow, designs and consultation were freely utilized as a matter of course. Since independence, the engineering works in India have assumed great complexity and coverage in respect of designs, techniques, raw materials, processes and construction requirements. The giant steel mills, oil refineries, atomic reactors, weather satellites, supersonic jets, radar, gigantic thermal and hydro stations, electronics, complicated structural forms, new materials of construction, etc., are now a normal feature of the development programme. For implementation, they require a whole army of scientists and engineers with wide experience in planning, plant design, construction and operation. Besides, they need expertise in many specialized fields, both in engineering and science, as also in managerial skill. To meet these growing needs the present system of science education, engineering education, and practical training must, therefore, undergo radical change and include more of science content, and stress on intensive training in design, in the plant and in the field. Also, there must be a sense of urgency.

Scientific research and engineering research must proceed side by side and in co-ordination, so that the time-lag between discovery and its application is reduced to the minimum. According to experience in the U.S.A., the U.S.S.R., and elsewhere, the expense on pure science research accounts for only about 5%, and on applied research the remaining 95% of the overall expenditure on research. Pure science and applied science are the two facets of science, and the interplay between these two has been responsible for all the modern discoveries and their translation into concrete realities for the benefit of mankind. Research in pure science leads to new knowledge, but new knowledge, to be useful and be able to add to human wellbeing, has to be given concrete shape. Basic research creates new ideas. Engineering research translates these new ideas into new machines, new techniques, and new processes. In that process it meets new problems, which again demand further basic knowledge and thus stimulate further scientific investigation. This interplay of science and engineering goes on and results

Maj.-Gen. Harkirat Singh then installed Dr. Sen as President for 1962-63. (*Applause*).

7. Dr. Sen then delivered the Presidential Address (see pages 47 to 52).

8. Dr. Sen next conferred the Presidential Scroll on the retiring President, Maj.-Gen. Harkirat Singh. (*Applause*).

9. Dr. A. N. Khosla, Governor of Orissa, then delivered the Inaugural Address.

'Mr. President, Fellow Engineers, Ladies and Gentlemen,

I feel honoured in having been invited to inaugurate the 43rd Annual Convention of the Institution of Engineers. I have been a member of this Institution since the thirties, and have watched its steady growth. I have also seen it passing through crises, which, I am happy to say, it has invariably survived. I understand the present membership stands at nearly 40,000. But there are still a large number of engineers who are not yet members. In their own interest and in the interests of their profession, they should join the Institution. There should be a concerted drive for enrolment at all the Local Centres and the Headquarters.

I have watched serious attempts being made for the dismemberment of this Institution through the setting up of parallel Institutions to cater for one particular discipline or sub-discipline, sometimes through conviction and sometimes to satisfy group ambition. This Institution has, however, survived. It continues to represent all of engineering, civil, mechanical, electrical, telecommunication, mining, metallurgy and chemical. This is in the true spirit of democracy, where all disciplines have full opportunity of expression and growth. This Institution has on its Roll engineers from each and every branch, so that representatives of each branch have an effective voice in the administration of the Institution commensurate with the strength of their membership.

One must recognize the essential unity of the engineering profession. With the inevitable increase of specialization, there is an increasing need to secure a common understanding and sympathy, as any great engineering work is bound to be a joint operation. Modern trends and developments require an integration of all engineering disciplines and techniques as well as of basic sciences. In the nuclear and space fields, the subdivisions within engineering are already losing much of their functional distinction. It is thus most desirable that all engineering disciplines should combine under one common Institution, with full freedom for growth and development assured to each, coupled with full coordination, understanding and interplay between related disciplines.

I am glad that the Government of India has finally decided to re-establish the All-India Service of Engineers. This will be a great step forward in bringing about a unity of outlook among engineers throughout India and a wider grasp of the problems facing individual States on an all-India basis. It will also help to highlight the essential unity of the engineering profession.

The engineering of today in India is very different from the engineering of pre-independence days. We have not yet stepped into the space age; but we are very much in the nuclear age, both in respect of research and production. Giant irrigation

6. Maj.-Gen. Harkirat Singh next introduced Dr. T. Sen, President-Elect, for 1962-63, in the following terms:

'I am very glad to introduce to you the President of the Institution for 1962-63, Dr. Triguna Sen. Dr. Sen has had a very chequered career. After completing his post-graduate studies in Germany, he obtained a doctorate in mechanical engineering specializing in fluid mechanics and hydraulic machinery.

Dr. Sen returned from Europe in 1932. In that year he was arrested under Bengal Ordinance and put in a detention camp. You will remember that those years were a period of intense political activity in this country. After a year, Dr. Sen was externed from the then Presidency of Bengal and lived away from his home till 1939 when the ban was lifted. During these years, Dr. Sen was in Dibrugarh as Manager of the Dibrugarh Electric Supply Co.

Dr. Sen returned to Calcutta as Administrative Officer of the College of Engineering and Technology, Jadavpur. He then became Principal of the College and remained in this capacity till 1956. In that year when the Jadavpur University was established, he was appointed its first Vice-Chancellor.

In 1957, Dr. Sen went to Europe and North America to study the educational systems in the different universities. He interpersed these educational and academic activities with two terms as Mayor of Calcutta for the years 1958 and 1959. I have heard that these two years of Mayoralty were marked with great dynamism in the affairs of the city of Calcutta.

In 1959, he visited Germany to study, in particular, university administration. In the following year, he visited France to study the educational system in the higher secondary schools in that country.

Dr. Sen is connected with a large number of educational institutions in this country, and on the present occasion, I can only give two or three instances. He is President of the Executive Council of the Inter-University Board of India, Member of Central Advisory Board of Education of the Government of India, Member of the All-India Council for Technical Education, and a Member of the Indian National Commission for Cooperation with UNESCO.

He is, besides, the Vice-President of the Indian Association for the Cultivation of Science, and a Member of the Executive Council of the Indian Science Congress Association. Both in 1961 and again 1962 he was elected President of the Association of Principals of Technical Associations (India). Dr. Sen is also a Director of a number of public and private companies, and his cultural activities are again too long to mention here.

Dr. Sen has been a member of the Institution Council for a number of years, and he was also Chairman of the Bengal Centre. He has taken the keenest interest in the work of the Institution, more particularly the academic side, and we in the Council have greatly valued his mature advice on many pressing problems. At a personal level I have always found his charm of manner very infective.

I have now very great pleasure in installing Dr. Triguna Sen as President of the Institution for 1962-63.'

In 1962 he was made a Member of the Planning Commission where his great abilities and experience could be of further service in the problems of national development.'

Maj.-Gen. Harkirat Singh then presented the Scroll of Honorary Life Member to Dr. Thacker. (*Applause*). Dr. Thacker signed the Register of Honorary Life Members and said that it was a moment of great significance for him and he was very conscious and profoundly appreciative that the same honour as had been conferred on so eminent an engineer as Dr. Khosla was also being conferred on him. (*Applause*)

5. Maj.-Gen. Harkirat Singh then announced the award of the following prizes by the Council and the Trustees of the Public Charitable Trust for the Advancement of Engineering Education respectively:

The Council of the Institution have awarded the following prizes for the year 1960-61:

(1) The President of India's Prize for the best paper published in the *Journal* to Shri D. Mookerjea (*M.*) for his paper 'The Kosi—a Challenge in River Control'.

(2) The Railway Board's First Prize for the best paper on railway engineering or subjects allied to it to Dr. C. V. S. Ratnam (*A.M.*) for his paper 'Utilization of Non-Coking Coals for Iron and Steel Making'.

(3) The Railway Board's Second Prize for the second best paper on railway engineering or subjects tallied to it to Shri B. V. S. Rao (*A.M.*) for his paper 'Special Features of 25 kV A.C. Electric Traction with Particular Reference to Ignitron Electric Locomotive'.

(4) A Union Ministry of Irrigation and Power Prize for the best paper on the civil engineering aspects of river valley development to Shri K. Seetharamiah (*M.*) and Shri A. S. Ramamurthy (*Non-member*) for their paper 'Hydraulic Jump Stabilization'.

(5) An Institution Prize to Dr. A. K. Chatterjee (*M.*), Shri K. V. Ramanan (*Non-member*) and Shri B. S. Rao (*Non-member*) for their paper 'Suppressor Grid Controlled Voltage Stabilizers'.

(6) An Institution Prize to Shri S. N. Das (*A.M.*) for his paper 'Batch Production Under Piecework System'.

The Trustees of the Public Charitable Trust for the Advancement of Engineering Education have awarded the following prize:

Dr. K. L. Rao's prize for the best paper on the subject of Hydraulic Similitude to Shri M. M. Dandekar (*A.M.*) for his paper on 'Hydraulic Similitude'.

As the prizes were announced by the President, the presentations were made by Dr. Khosla to the recipients who were present in person. These were Shri D. Mookerjea, Dr. C. V. S. Ratnam, Shri K. Seetharamiah and Dr. A. K. Chatterjee.

was largely responsible for cooperative research in various industrial fields. Science and industry were brought in close liaison, and the national laboratories and the universities achieved closer cooperation.

In 1957 Dr. Thacker was appointed Secretary to the Government of India in the Ministry of Scientific Research and Technical Education (later Ministry of Scientific Research and Cultural Affairs) and Education Adviser (Technical), in addition to being Director-General of Scientific and Industrial Research. In this enlarged orbit he made outstanding contributions for the encouragement of research everywhere and for intensifying work in the survey of natural resources in the country. He was instrumental in the establishment of a number of higher technological institutes, engineering colleges and polytechnics for the increase of national technical manpower, and expansion of the facilities for engineering and technological research. As Chairman of the Technical and Professional Education Working Group of the Planning Commission he guided plans for the expansion of technical training in the country. And as Chairman of the Post-Graduate Committee he laid the plans for the reshaping of post-graduate studies.

Dr. Thacker is the author of numerous papers, monographs and memoirs. He has received numerous medals and awards both nationally and internationally. He has been honoured by many universities by conferment of honorary Doctorate degrees in Science. Engineering and Letters. He was awarded the Padma Bhushan in 1955 for his distinguished service to science and engineering in India.

Dr. Thacker was elected to numerous high offices in national and international bodies and conferences. He has headed many commissions of the Government of India and led many Indian delegations to international scientific and engineering conferences. He has been very closely associated with professional and learned bodies and societies both in India and abroad. He was President of the Institution of Engineers (India) in 1955-56, and has been President of the Indian Science Congress, President of the Institute of Metals, President of the Central Board of Irrigation and Power, and President of the Association of Principals of Technical Institutions (India). He is a Fellow of the National Institute of Sciences, and the only Indian Fellow of the American Institute of Electrical Engineers. He is also an Honorary Fellow of the Institution of Telecommunication Engineers, and an Honorary Fellow of the Institution of Surveyors (India).

Dr. Thacker has been called upon to serve as Chairman or President of several international organizations and conferences. In 1961 he presided over a session of the United Nations Conference on New Sources of Energy in Rome. He is India's representative on the Standing Commitee of the British Commonwealth Scientific Conference and was Chairman of the Commonwealth Scientific Committee in 1960-62. He is the Chairman of the International Advisory Committee on Research in the Natural Sciences of the United Nations Educational, Scientific and Cultural Organization. Early this year, on the invitation of the Secretary-General of the United Nations, he presided at Geneva over the first United Nations Conference on the Application of Science and Technology for the Benefit of Developing Areas of the World.

1950-51; President of the Central Board of Irrigation and Power, 1946, 1947, 1948 and 1951; President, National Institutes of Sciences of India, 1960-62; Founder President, International Commission on Irrigation and Drainage, 1951-54, and its Honorary President since; Vice-President, World Power Conference, 1948-53; Vice-President, International Commission on Large Dams, 1946-51; Vice-President, International Association for Hydraulic Research, 1948-53; and Vice-President, Union of International Engineering Organizations of the UNESCO, 1950-53.

Dr. Khosla is the recipient of numerous honours. He was awarded the Padma Bhusan in 1954; Doctor of Engineering (Honorary), Rensselaer Polytechnic Institute, U.S.A., in 1956; Doctor of Engineering (*Honoris causa*), University of Roorkee, in 1959, and Doctor of Science (Engineering) (*Honoris causa*), University of Punjab, in 1961.'

Maj.-Gen. Harkirat Singh then presented the Scroll of Honorary Life Member to Dr. Khosla. (*Applause*). Dr. Khosla signed the Register of Honorary Life Members and said how deeply he appreciated the honour, which he considered was the highest of the honours yet conferred or might be conferred on him in the future. (*Applause*)

Maj.-Gen. Harkirat Singh then called upon the Secretary, Shri Seshadri, to read the citation for Dr. Thacker. Shri Seshadri read the citation as follows:

'After a first class academic career in the United Kingdom, Dr. Maneklal Sankalchand Thacker began his distinguished career in the Electricity Department of the Bristol Corporation in 1929. In 1931 he joined the Calcutta Electric Supply Corporation as the first Indian on covenanted service. Before he left the Calcutta Electric Supply Corporation in 1947, he had risen to a senior technical and administrative position.

In 1947, Dr. Thacker went to the Indian Institute of Science in Bangalore as Professor and Head of the Department of Power Engineering and Electrical Technology. Two years later he became, in addition, the Director of the Institute. During this phase of his career, Dr. Thacker was responsible for the extension of the post-graduate research facilities in all Departments of the Institute, and the work of the Institute took a great leap forward under his energetic and able direction.

Dr. Thacker was also intimately associated with the work of power development and technical education in the country, and played an outstanding part in many activities concerning science and engineering research.

The progress made by the Institute and his own distinguished academic work led to the Government of India's invitation to Dr. Thacker in 1955 to accept the position of Director-General of Scientific and Industrial Research when it became vacant in that year. His became the responsibility of directing and administering the activities of the Council with its great network of national laboratories and research institutes.

His boldness and vision as a scientist and administrator were exemplified in the following years when these activities were geared to the national development plans and the founding of new laboratories for scientific and engineering research. Under Dr. Thacker's guidance, research in all fields received fresh stimulus and support. He like the Bhakra, Chambal, Damodar Valley, Hirakud, Kosi, Narmada and Tapti have been constructed or are under construction. The Bhakra, Chambal, Damodar Valley, Hirakud and Tapti (Kakrapara) projects have been completed, and others on the Narmada, Tapti and other rivers are under construction or under active consideration. Special mention is necessary of the Hirakud project on the Mahanadi river, which he conceived in May 1945, soon after assuming charge as Chairman, Central Waterways, Irrigation and Navigation Commission, as the first stage of his plan for the integrated development of the Mahanadi valley, and the construction of which he directed till 1953. This project was completed in early 1957—a record time of 12 years between conception and completion of a project of this magnitude. Dr. Khosla may thus well be called the father of the river valley projects in India.

His other achievements during this period were the settlement of the differences between the Madras and Orissa States on the Machkund project and the Hyderabad, Madras and Mysore States on the Tungabhadra project.

In 1953-54, as Special Secretary to the Government of India, he led the Indian delegation to the United States for the Indus Waters dispute with Pakistan. These negotiations in which he played a prime part led to the World Bank proposals which later formed the basis of the Water Treaty between India and Pakistan.

On 17th September, 1954, he assumed charge as Vice-Chancellor of the University of Roorkee, his *alma mater*, a post which he held for a little over five years. These years witnessed great activity and expansion. Admissions increased fourfold. New laboratories and other buildings were built. Post-graduate courses and research work were introduced on an extensive scale. A substantial Research Fund of Rs. 1,15,000 was created out of his earnings to stimulate research at the University. In 1957, he was deputed by the Government of India to advise the Government of Sudan on the appraisal and development of water resources in that country.

He was a Member of the Rajya Sabha from April 1958 to October 1959. In December 1959 he was appointed Member of the Planning Commission in charge of Education, Health and Scientific Research. In 1962 he was appointed Governor of Orissa, an historic event for engineers in this country, as this was the first time an engineer was appointed as Governor of a State. He took up his latest assignment on 15th September, 1962.

Despite his exacting duties as Governor, Dr. Khosla continues to take active interest in engineering, particularly river valley development. He is still the Chairman of the Boards of Consultants of the Balimela, Beas, Bhakra, Pamba-Kakki and Ramganga river valley projects.

Dr. Khosla is the author of numerous papers and treatises. He received the Punjab Engineering Congress Gold Medal and the Kennedy Gold Medal each on two occasions for outstanding papers. His book on Design of Weirs on Permeable Foundations is now a classic work on the subject.

Dr. Khosla was elected to numerous high offices in national and international bodies and conferences. From a list too numerous to be catalogued should be mentioned the following: President of The Institution of Engineers (India), 1949-50 and

From July 1918 to March 1920, during the First World War, he was with the Mesopotamia Expeditionary Force in Iraq as a Commissioned Officer, when he made his first important contribution to engineering by the invention of the Khosla Disc for precision levelling across rivers and wide valleys. He was appointed to the Indian Service of Engineers in 1919.

On discharge from military service, he was appointed to the Sutlej Valley project, where he carried out surveys and investigations of all the four headworks, and was then posted to the Suleimanki Barrage for construction. Here, during 1921-26, he evolved and introduced precast concrete units for use on the barrage and a variety of other constructions.

He later remodelled the Maria headworks and the Upper Chenab Canal works, assumed charge of the Panjnad Barrage immediately on its completion, and then carried out the reconstruction of the Khanki Weir. During these nine years, he carried out intensive research on the flow of water through subsoils in relation to stability of hydraulic structures. These researches culminated in 1936 in the publication of his treatise on Design of Weirs on Permeable Foundations. This is his most outstanding contribution to world engineering science.

His next prominent achievement was the construction of the Trimmu Barrage, which was designed according to his theory, and which he, along with six other Indian engineers, completed in a record time of two years (14th April, 1937, to 2nd April, 1939, from start of preliminary surveys to designs, construction and final completion) with a saving of Rs. 1 crore out of the estimated cost of Rs. 2½ crores. Similar barrages of this magnitude like the Panjnad, Islam, Suleimanki and Ferozepur constructed between 1921 and 1932 had each taken about five years to complete. This was the first major project ever to be entrusted to Indian engineers, and its completion in record time and with very substantial savings was a tremendous gain for the prestige of Indian engineering.

As Superintending Engineer, High Dam Circle, he investigated the water and power resources of the Punjab and prepared plans for their development, a number of which have been/or are being implemented. During this period, he made a very important contribution by establishing a rational relationship between rainfall and run-off and by his paper on Silting of Reservoirs.

On 14th August, 1943, he was appointed Chief Engineer and Secretary to the Punjab Government very much out of turn. In February 1945, he was appointed Consulting Engineer to the Government of India and first Chairman of the Central Waterways, Irrigation and Navigation Commission (now Central Water and Power Commission) and also Additional Secretary to the Government of India in the Ministry of Works, Mines and Power. He organized this Commission from its beginning and simultaneously reorganized and developed the Poona Research Station at Khadakvasla into the Central Water and Power Research Station. Till his retirement from the post in 1953, these years marked a period of outstanding achievements in the field of river valley development. He initiated investigations of the water and power potential of river valleys in the country as a whole and of several individual projects. Many of these cation links are established, and buildings for industries are erected, would facilitate the immediate all-round increase in the internal production and preparedness for external aggression. This to a large extent depends upon the response and concerted effort of the engineers. A body like that of the Institution of Engineers can inspire and enthuse the young engineers of the country to the greater task of national reconstruction, development and defence.

Gentlemen, I am sure you will understand when I say that the country expects of its engineers the highest standards of conduct and technical efficiency.

In conclusion, I may reiterate the importance of the engineers today and tomorrow, whether it is from the point of view of industrialization or of utilizing the country's vast natural resources or of providing employment on a substantial scale, or from the point of the defence of the country. I, therefore, appeal to the members of this expert gathering to increasingly contribute their undoubted knowledge, skill and talent to the solution of the vast problems facing the country resulting in the realization of a bright, busy and happy India, the vision of our beloved Prime Minister and of every Indian, in the very near future.

Jai Hind.'

3. Shri S. Rajanayagam, Past-President of the Institution of Engineers, Ceylon, conveyed the greetings of that Institution and said the Institution of Engineers, Ceylon, look forward to a period of increased collaboration with the Institution of Engineers (India) for the benefit of both.

4. Maj.-Gen. Harkirat Singh then conferred the Honorary Life Membership of the Institution on Dr. A. N. Khosla and Dr. M. S. Thacker. He said :

'The Honorary Life Membership of the Institution is the highest honour conferred by the Institution. During its long history, it has been conferred on a very few people only, people who had attained the very highest eminence in engineering.

It differs from other high honours in that it is the highest honour conferred on an engineer by others in the engineering profession. It is therefore the highest professional honour.

The late Sir Mokshagumdum Visvesvaraya was for many years the Institution's only Honorary Life Member. Today the Institution is conferring the honour on two of its own Past-Presidents who have attained world eminence in engineering. By doing so, as its President I would like to say the Institution is honouring itself.'

He then called upon the Secretary, Shri B. Seshadri, to read the citation for Dr. Khosla. Shri Seshadri read the citation as follows :

'After graduating from the Thomason Civil Engineering College, now the University of Roorkee, Dr. Ajudhia Nath Khosla joined the Irrigation Branch of the Punjab Government in September 1916. His first assignment was the survey and investigation connected with the Bhakra Dam project. The Bhakra Dam has now been built on the very axis line marked by him in July 1917. He has been directly connected with the project ever since, and is now Chairman of its Board of Consultants.

43RD ANNUAL GENERAL MEETING, BANGALORE, MAY 1963

Dr. Khosla Replying to the Toast to the Chief Guest

Shri Nijalingappa Replying to the Toast to 'Our Guests'

43RD ANNUAL GENERAL MEETING, BANGALORE, MAY 1963

Shri B. R. Manickam Proposing A Vote of Thanks to Dr. Khosla

The Annual Dinner
Prof. Dhawan, Maj.-Gen. Harkirat Singh, Shrimati Dhawan, Dr. Khosla, Dr. Sen and Shri Nijalingappa

43RD ANNUAL GENERAL MEETING, BANGALORE, MAY 1963

Dr. T. Sen Delivering the Presidential Address

Dr. A. N. Khosla Delivering the Inaugural Address

43RD ANNUAL GENERAL MEETING, BANGALORE, MAY 1963

DR. A. N. KHOSLA SIGNING THE REGISTER OF HONORARY LIFE MEMBERS

MAJ.-GEN. HARKIRAT SINGH INTRODUCING DR. T. SEN TO THE GATHERING

43RD ANNUAL GENERAL MEETING, BANGALORE, MAY 1963

Shri Veerendra Patil, Minister of Public Works, Mysore, Welcoming the Gathering

Shri S. Nijalingappa, Chief Minister of Mysore, Addressing the Gathering

Mysore has an impressive tradition and record of achievement in the industrial field. Long before basic industries were set up in the public sector in other States, Mysore had its iron and steel and fertilizer factories, apart from other industrial undertakings. The State is also known for its mineral wealth. It is the home of a large number of minerals of economic importance. It contributes all the gold that is produced in India. Its resources of iron ore are enormous and Hospet ore has the highest percentage in the world. It contains abundant quantities of other ferrous minerals like manganese and chromite. Its wealth of building and ornamental stones are unrivalled.

Mysore has produced many great engineers who have contributed much to the progress of the country. In this connection mention may be made of the part played by the engineer-statesman Sir M. Visvesvaraya whose life was one of dedication, and systematic and sustained hard work. Beginning as a young engineer in the later part of the last century, he blossomed into a constructive statesman of world renown and vision. Although his field of bold experiments was a relatively small State in the south, he shaped it into a model and pursued development policies whose place and significance in the advancement of the country is now being realized at the all-India level.

Sir M. Visvesvaraya confidently predicted planning for development and phased economic programmes before any other country adopted them, and which today India is following with success. In the field of resource development he advocated an integrated outlook, before the T.V.A. conception came to be popular. His schemes for the Neera and Mutha Canals in Bombay, the Cauvery River in Mysore, the Musi and Isi Rivers in Hyderabad, and his recommendations for the Mahanadi in Orissa are in line with such a conception, the resources of the valleys in their entirety. Many sided and complete utilization of rivers for perennial irrigation, power generation, flood absorption, city supplies and industries were ever the theme and substance of engineering projects envisaged by him. In the teeth of opposition of an alien, often sceptical, Government, he fought for industrialization of the country. And he never was tired of championing, in fearless opposition to cries among his own countrymen of earlier days, the vital role of mechanization for India's survival and advancement. The Hindustan Aircraft Factory, the automobile, steel, electrical and numerous other basic industries in India owe their status today to his farsighted vision and his faith in India. His ambition for India's economic advancement was of such a farsighted order that many of the model schemes he had worked out with loving care were yet to be brought into being. In fact it would be a truism to say that Sir M. Visvesvaraya is the 'father of planning in India'.

The nation is facing today a situation of extreme gravity, arising from China's invasion of our Motherland—an invasion for which China has been making secret preparations for quite a long time. This open and unabashed aggression was resisted by our defence forces in extremely difficult conditions. The cardinal importance of increasing production to the maximum extent possible in all sectors of the economy needs no stressing. This battle has to be won in farms and factories. An all-out effort is required to step up the internal production both in agriculture and industry. The role of engineers in an emergency like this cannot be exaggerated. The speed with which the irrigation and power schemes and engineering works are executed, communitry by conducting examinations twice in a year—the Studentship Examination and the Associate Membership Examinations in Sections A and B, the passing of which has been recognized as equivalent to the passing of an engineering degree examination. I am also happy to learn that these examinations are being conducted at 24 centres distributed all over the country and over 10,000 candidates appear for these examinations each time. Thus the Institution is training graduate engineers and trying to reduce the existing shortage of engineering personnel urgently required for the execution of the Five-Year Plans. This, I consider, is really a very valuable service rendered to the country by your Institution. The Institution is also facilitating the exchange of latest information in engineering science and practice by its monthly *Journal* and *Bulletin*.

We have now in India a large number of retired engineers who have rendered very useful and specialized service to the country during their period of service. It would be a great advantage to the country if the rich experience can be utilized in the development of the country. In Mysore, some retired engineers have been rendering valuable service in the field of engineering education. Similarly, it may be possible to utilize their services in other useful fields. I would therefore request this august body to examine this question in all its aspects and suggest suitable practical proposals for implementing this objective.

As you are all aware, this is an age of science and technology, and unless we keep abreast with latest techniques and developments all over the world, India cannot march in tune with other countries. I need not impress upon you, therefore, the need for continued and vigorous efforts to develop researchmindedness amongst the engineers in the country. It is obvious that the object of the research is to make available to the engineers working in the field the latest technical information and results of laboratory experiments to make their task lighter, less speculative, and more economical. Now that the expenditure on development in the engineering field has risen to phenomenal proportions, the importance of research is all the more significant in the present day construction field. Hence, practical means by which this could be developed amongst the Indian engineers are required to be considered. I trust you will give your thoughts to this question and furnish your valuable suggestions on the subject.

In this connection, it would not be out of place if I enumerate the development of this State during the Second and Third Five-Year Plans. The total area of the reorganized State is 74,210 sq. miles, and the population of the State according to the 1961 Census is 2.36 crores. In population, according to the 1961 Census, Mysore stands eighth with 5.38% of the national figure. In area it takes the sixth place with 6.3% of the total area of the Indian Union.

During the Second Five-Year Plan, Rs. 145.13 crores were spent on the development works in the State. During the Third Five-Year Plan it is estimated that about Rs. 250 crores will be spent on the development works. The amount spent and to be spent on some of the major heads during the two plans is, in agriculture Rs. 14.04 crores, power 96.95 crores, irrigation 97.15 crorees, industries 24.96 crores, communications 20.94 crores, and education 32.06 crores.

These figures indicate the vast strides in the development of the State.

2. Shri S. Nijalingappa, Chief Minister of Mysore, addressed the gathering as follows :

'Dr. Khosla, General Harkirat Singh, Dr. Sen, Ladies and Gentlemen,

I would like to associate myself with my colleague Shri Veerendra Patil in welcoming you all for this 43rd Annual Convention of the Institution of Engineers. We are particularly happy at this Convention being held in this State after an interval of twelve years. We are happy that Dr. Khosla, one of the foremost engineers of our country and who has now taken the responsible position of the Governor of Orissa, is here with us today to deliver the Inaugural Address of this Session.

The Indian engineer of today unlike his counterpart before independence comes into almost every field of national planning for bringing about a welfare State. Our enormous hydro, coal, atomic and more than all, manpower potentials have to be fully utilized. Every available drop of water needs to be brought to use for irrigation. Many parts of our country have to be protected from the yearly ravages of floods. Communication facilities have to be improved and expanded in order to connect the rural areas. Schools, colleges, factories, warehouses and dwelling houses for all have to be built. Poverty and unemployment have to be banished and every household should be made fit for contributing to the national welfare.

It has been the aim of the Government since independence that the country should develop in such a manner as to provide the basic necessities of life to everyone. One of the major decisions taken in this context is the policy of rapid industrialization and increased agricultural production. For the success of this policy it is not enough to make advancement, howsoever great, in isolated fields. All the sectors of productive activities must be integrated and should unitedly move forward in harmony so as to avoid lopsided development and to provide maximum benefit. The bulk of the development proposed in the various Plans pertain to the activities with which the engineers are not only intimately connected but are entrusted with their execution. In fact, irrigation, power, village and small scale industries, heavy industry, mining, transport and communications form nearly 75% of the investment in the Third Five-Year Plan, which are practically entirely the sphere of activity of engineers. Everyone is therefore convinced of the predominant role of the engineers in the execution of the Five-Year Plans. The duties and responsibilities in the building up of the nation need no reiteration. The Five-Year Plan now taken up and those that will follow have thrown a big challenge to the engineering fraternity and the success and achievement of these Plans depend to a large extent on them.

The activities of the Institution of Engineers are directed towards the promotion and advancement of the science, practice and business of engineering in all its branches. With its Head Office at Calcutta and eighteen Local Centres spread all over the country, the Institution along with its eminent members is helping directly and indirectly the execution of the Five-Year Plans. Besides serving as an expert technical body in the field of engineering, giving advice on important engineering matters which are of vital importance to the successful completion of the engineering enterprises, it is also serving as a technical training organization wherein it is training graduate engineers in the coun-

Beginning in the west from the palm-fringed coasts of the Arabian Sea and passing through the lofty ranges and evergreen forests of the Western Ghats, Mysore's scenic aspect changes gradually into the verdure of undulating plains and river valleys. The Cauvery, the Krishna and the Tungabhadra—the biggest rivers in the State—course through its territory and give life to agriculture and industry. These natural resources of the State are being harnessed by our engineers for the welfare of the people.

I value this opportunity of meeting distinguished engineers from all parts of the country, at this 43rd Annual Convention of the Institution of Engineers. It is being held at a time when the country is facing a grave emergency and is confronted with the twin tasks of defence and development. In both these tasks, engineers have a vital role to play. Besides, we are in the third year of the Third Five Year Plan. We are seeking to assess our achievements and failures in the past and review the progress made so far, which will facilitate the course and action to be adopted in the coming years. I am sure that the country will be greatly benefited by the deliberations at this Convention and by your considered suggestions tendered on various problems confronting the country particularly in the field of development activities with which engineers are actively associated.

Being the Minister in charge of Public Works, I am aware of the vital role of the engineers in the execution of many of the developmental works in the country. It is by the cooperation and coordination of the activities of engineers at all levels that better results can be achieved. This Convention offers itself an opportunity of exchanging views among yourselves and suggesting ways and means of overcoming the difficulties experienced in the execution of many projects in the country. I hope that it will be possible for you to find some time to discuss the no less important topic of improving the standard of engineering education and also to offer your considered views on the optimum utilization of the existing engineering personnel in the country. I am sure that in these days of advancement in science and technology, the deliberations of this august body will guide the country to achieve greater speed in developmental activities and ensure economy in construction costs.

The 43rd Annual Convention of the Institution of Engineers will be memorable also, apart from other reasons, on account of the conferment of Honorary Life Membership of the Institution on Dr. A. N. Khosla and Dr. M. S. Thacker. Both Dr. Khosla and Dr. Thacker have played many important roles and each one of them with distinction. They have both acquired international reputation. By conferring Honorary Life Membership on these distinguished sons of India, the Institution of Engineers is honouring itself.

I have no doubt that you will all enjoy the many colourful cultural programmes as also the excursions that have been arranged for you and carry back very pleasant memories of the Bangalore Convention.

I extend to you all, once again, a very hearty welcome.

Jai Hind.'

Resolved further that the above be recommended to the General Body at the Business Session of the 43rd Annual General Meeting the same afternoon for approval'.

The General Body *Resolved* that the Council's recommendation be accepted, and the Council for 1961-62 continue as the Council 1962-63 with the changes as recommended, till the constitutional position is cleared and a new Council is duly constituted.

With a vote of thanks to the Chair, the Session terminated at 3.45 p.m.

Inaugural Session, Sunday, May 19, 1963

The Inaugural Session was held in Rabindra Kalakshetra, Bangalore, at 9.00 a.m. Over 1,200 members and guests attended the Session.

Dr. A. N. Khosla, Governor of Orissa, inaugurated the Session. He arrived at the Rabindra Kalakshetra with Shri S. Nijalingappa, Chief Minister of Mysore, at 8.50 a.m. They were received by Shri Veerendra Patil, Minister for Public Works of Mysore and Chairman of the Reception Committee of the Mysore Centre, Maj.-Gen. Harkirat Singh, President, Dr. T. Sen, President-Elect, and Shri B. R. Manickam, Chairman of the Mysore Centre, and introduced to the Past-Presidents and members of the Council for 1962-63.

Messages for a successful Convention were received from the following :

The Institution of Chemical Engineers, London; The Institution of Electrical Engineers, London; The South African Institution of Civil Engineers; and Société Royale Belge des Ingénieurs et des Industriels.

1. Shri Veerendra Patil, Chairman of the Reception Committee, welcomed the delegates in Bangalore as follows :

'Dr. Khosla, General Harkirat Singh, Dr. Sen, Beloved Chief Minister, Ladies and Gentlemen,

It gives me a great pleasure to extend to you all on behalf of the Government of Mysore, a warm welcome to the 43rd Annual Convention of the Institution of Engineers. I am particularly happy that this momentous Annual Convention should be held in the city of Bangalore. Planned on modern lines and fast expanding into an industrial centre. Bangalore has the distinction of having not only a salubrious climate but also a number of large industrial establishments in the public as well as in the private sectors. Besides, those interested in scientific research would not miss the Indian Institute of Science founded by the House of Tatas.

Mysore has the singular fortune of having been served by successive able and liberal administrators. By their relentless efforts, Mysore has the distinction of achieving a balance between industry and agriculture, science and art, education and culture. It is here in this State that the first river valley scheme was conceived, planned and implemented. In this connection, I refer to the Krishnarajasagar and basinwise development of the storage and canal system of the River Cauvery, visualized and fulfilled by that pre-eminent engineer-statesman and father of economic planning, Sir M. Visvesvaraya.

Jammu & Kashmir Centre	B. N. Mengi
Kerala Centre	V. Ranganathan
Madhya Pradesh Centre	Prof. A. Lakshmanaswamy
Madras Centre	Prof. A. Srinivasan
Mysore Centre	B. R. Manickam (re-elected)
Nagpur Centre	K. S. Ramu
Orissa Centre	S. S. Behera (re-elected)
Poona Centre	Prof. M. V. Deshpande
Punjab Centre	Jatindra Singh
Rajasthan Centre	K. C. Satsangi
Uttar Pradesh Centre	K. N. Misra

5. Shri S. Basu (*Member*) proposed that Messrs. Price, Waterhouse, Peat & Co. be reappointed Auditors of the Institution for the year 1962-63 on a remuneration of Rs. 3,000 per annum. This was seconded by Shri Dinesh Mohan (*Member*) and was carried unanimously.

6. The President then took up the Supplementary Agenda and put to the General Body the following Resolution 15 of the Council passed at their 425th Meeting dated 20th May, 1962:

'*Resolved* that the Secretary's proposal for the processing of Graduateship and Studentship applications wholly in the Headquarters for the purpose of expedition be approved, and the Secretary accordingly prepare suitable revisions to the concerned Bye-laws for placing before the General Body at the next Annual General Meeting of the Institution.'

The General Body *Resolved* unanimously that the Councils's recommendation be accepted, and the new procedure for the processing of Graduateship and Studentship wholly in the Headquarters be made operative with immediate effect, and suitable revisions be incorporated in the concerned Bye-laws after the present constitutional impasse was cleared.

With the permission of the Chair, the following item was also considered:

7. The President then put to the General Body Resolution 1 of the Council passed at their 428th (Adjourned) Meeting that morning in regard to the composition of the Council for 1962-63:

'Reconstitution of the Council for 1962-63.

Resolved that the Council for 1961-62 continue as the Council for 1962-63 till the constitutional position is cleared, with the following changes:

The new President for 1962-63 will take the place of the President for 1961-62; the newly elected Chairmen of the Local Centres will take the places of the present Vice-Presidents; the President for 1961-62 will take the place of the seniormost Past-President as *ex-officio* members of the Council; the Sectional Chairmen and elected members of the Council will continue to be members of the Council; and the co-opted members will cease to be members of the Council for 1962-63.

PROCEEDINGS OF THE FORTY-THIRD ANNUAL CONVENTION BANGALORE, MAY 18-22, 1963

The Annual General Meeting

Business Session, Saturday, May 18, 1963

The Forty-Third Annual General Meeting was held at the Puttanna Chetty Hall, Bangalore, on Saturday, May 18, 1963, at 3.00 p.m.

About 200 members attended the Meeting, which was presided over by the President, Maj.-Gen. Harkirat Singh.

1. After welcoming the delegates to the 43rd Annual General Meeting, the President took up the minutes of the 42nd Annual General Meeting, circulated to all members of the Institution in the March 1962 issue of the *Bulletin*, for confirmation.

The President put the minutes to the house. Dr. V. M. Dokars (*Member*) proposed that the minutes be confirmed. Shri M. Ganapati (*Member*) seconded the proposal. This was carried unanimously.

2. The President next took up the minutes of the Meeting of Corporate Members held in New Delhi on 31st March, 1962, to consider revisions to Regulation 19 on the subject of annual subscriptions, circulated in the June 1962 issue of the *Bulletin* of the Institution, for confirmation.

Dr. H. C. Visvesvaraya (*Associate Member*) proposed that the minutes be confirmed. Shri N. N. Purandare (*Member*) seconded the proposal. This was carried unanimously.

3. The President then took up the Annual Report of the Council and the Audited Accounts for the year ended August 31, 1962, and asked if members had any comments to make.

Shri J. Datt (*Member*) proposed that the Annual Report be adopted and the Audited Accounts be approved. Shri P. Krishnaswami (*Associate Member*) seconded the proposal. This was carried unanimously.

4. The President then read the report of the Council on the election for 1962-63 of (i) The President, and (ii) The Vice-Presidents, as follows:

(i) The President announced that Dr. T. Sen had been elected as President for 1962-63. (*Applause*)

(ii) The following members by virtue of their having been elected Chairmen of Local Centres become Vice-Presidents of the Council under paragraph 6(d) of the Royal Charter:

Andhra Pradesh Centre	L. Venkatakrishnan
Assam Centre	K. Barua
Bengal Centre	S. Bandopadhyaya (re-elected)
Bihar Centre	D. Mookerjea
Bombay Centre	J. G. Bodhe
Delhi Centre	Maj.-Gen. S. P. Vohra
Gujarat Centre	M. M. Patel

Uttar Pradesh Centre

Chairman

K. N. Misra

Honorary Secretary

S. P. Sinha

Ex-officio Members of Committee

Jagdish Prasad
G. K. Agarwal
A. C. Mitra

Members of Committee

T. Ananthaswamy Rao
P. S. Bhatnagar
Dr. Jai Krishna
Lakshman Dev
J. P. Mittal
A. K. Roy

Brig. Shiv Dial Singh
Prof. S. R. Singh
S. P. Sinha*
P. N. Srivastava
R. D. Varma

Roorkee Sub-Centre

Chairman

G. Pande

Honorary Secretary

S. C. Dikshit

Members of Committee

S. C. Dikshit*
Dinesh Mohan
Dr. Jai Krishna
Dr. O. P. Jain

Prof. S. R. Singh
Col. K. C. Soni
H. G. Varma
Lt.-Gen. Sir Harold Williams

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* Names repeated

Poona Centre

Chairman
Prof. M. V. Deshpande

Honorary Secretary
D. R. Limaye

Jt. Honorary Secretary
B. V. Ramaswamy

Ex-officio Members of Committee

Brig. P. R. Kumar
M. L. Champhekar
D. V. Joglekar

Members of Committee

Brig. Arjan Singh
Col. P. R. Chauhan
G. T. Gokhale
D. R. Limaye*
A. G. Maydeo
Dr. N. S. Nandeeswaraiya
Lt.-Col. R. J. Nerurkar
B. V. Raman
B. V. Ramaswamy*
Prof. M. G. Shah
Col. G. S. Vishwanath

Punjab Centre

Chairman
Jatindra Singh

Honorary Secretary
H. C. Malhotra

Jt. Honorary Secretary
K. S. Prem

Ex-officio Members of Committee

D. C. Sharma
H. R. Bhatia
G. C. Khanna

Members of Committee

Balwant Singh
Dr. G. S. Dhillon
A. R. Garg
M. L. Jain
R. L. Khanna
H. C. Malhotra*
I. N. Mehta
H. C. Sahgal
Saran Singh
D. R. Singal
Sqn.-Ldr. Tara Singh

Rajasthan Centre

Chairman
K. C. Satsangi

Honorary Secretary
K. C. Mital

Ex-officio Members of Committee

K. N. Bhargava
V. G. Garde
Hari Sinha

Members of Committee

Prof. R. M. Advani
C. V. Govinda Rao
A. Krishnamachar
Prof. V. Lakshminarayan
Dr. D. R. Malhotra
B. D. Mathur
K. L. Mathur
M. L. Mathur
A. S. Mehta
K. C. Mital*
Prof. R. D. Singh

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* Names repeated

Members of Committee

J. B. Abraham
N. Bhaskaran
M. Ganapati
T. V. Lakshmanaswamy
N. Mahalingam
M. Meeran

T. Muthian
Prof. S. Panchanathan*
F. B. Pithavadian
P. Rajagopal Pillai
K. N. Srinivasan

Mysore Centre

Chairman

B. R. Manickam

Honorary Secretary

R. A. Rajagopal

Jt. Honorary Secretary

S. G. Ramachandra

Ex-officio Members of Committee

M. R. Arya
M. V. Narayana Rao
T. S. Narayana Rao

Members of Committee

J. C. L. D'Sa
Prof. C. Gopalakrishnan
Prof. N. S. Govinda Rao
Iftekhar Ahmed
Prof. D. B. Narasimhaiah

M. L. Narasimiengar
Prof. B. R. Narayana Iyengar
B. V. Patankar
E. K. Ramaswami

Nagpur Centre

Chairman

K. S. Ramu

Honorary Secretary

D. G. Tamaskar

Ex-officio Members of Committee

Y. K. Ghanekar
A. de Souza
S. F. Poacha

Members of Committee

D. R. Dalvi
D. V. Joshi
J. C. Karkaria*
S. T. Khare
Y. A. Khare
R. S. Mehta

V. S. Mokashi
Col. J. S. Sandhu
V. V. Sardesai
D. G. Tamaskar*
R. M. Tarkunde

Orissa Centre

Chairman

S. S. Behera

Honorary Secretary

S. Padhi

Jt. Honorary Secretary

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Jt. Honorary Secretary

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A. Bhattacharyya
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Bihar Centre

Chairman

D. Mookerjee

Honorary Secretary

Dr. B. N. Roy

Jt. Honorary Secretary

S. K. Sharma

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* Names repeated

COMMITTEES OF LOCAL CENTRES AND SUB-CENTRES 1962-63

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Honorary Secretary
Dr. J. Purushottam

Jt. Honorary Secretary
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A. R. Venkataraman
G. A. Narasimha Rao

Members of Committee

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Guru Parshad
Maj. G. V. V. Hanumantha Rao
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V. Parvatheesam
R. M. Patri
Dr. J. Purushottam*
S. A. Quader
M. A. Rahman
Brig. M. K. Rao
Brig. N. Sen Gupta

Nagarjunasagar Sub-Centre

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Honorary Secretary
Misbahauddin Khan

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A. S. Kameswara Rao
D. Kesava Rao
T. K. Mohana Rao
P. Krishan Raju
A. P. Ranganathaswami
M. B. G. Tilak

Assam Centre

Chairman
K. Barua

Honorary Secretary
S. C. Dey

Jt. Honorary Secretaries
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A. K. Roy Chaudhury

Ex-officio Members of Committee

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H. P. Barua

Members of Committee

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S. P. Chaudhury
S. M. K. Chistie
S. C. Dey*
H. B. Gupta
K. L. Mazumdar
M. Ramabrahmam
A. K. Roy Chaudhury*
B. D. Sarma
M. R. Sitaram
P. Sharma

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* Names repeated

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Assam
G. C. Goswami

Bengal
P. K. Ghosh

Bihar
D. Mookerjea

Bombay
J. G. Bodhe

Delhi
Maj.-Gen. S. P. Vohra

Gujarat
M. M. Patel

Jammu & Kashmir
B. N. Mengi

Kerala
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Madhya Pradesh
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Madras
M. Ganapati

Mysore
R. A. Rajagopal

Nagpur
K. S. Ramu

Orissa
S. S. Behera

Poona
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Punjab
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Rajasthan
K. C. Satsangi

Uttar Pradesh
K. N. Misra

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C. Seshavatharam

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B. N. Chaudhuri

Bihar
D. Mookerjea
G. S. Purohit

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N. N. Purandare

Delhi
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Gujarat
G. S. Desai
M. M. Patel

Jammu & Kashmir
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V. D. Zadoo

Kerala
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S. Varadaraja Sarma

Madhya Pradesh
Maj. L. R. Baronia
M. Y. Koli

Madras
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Prof. A. Srinivasan

Mysore
B. V. Patankar
C. N. Shama Rao

Nagpur
H. G. Chaoji
K. S. Ramu

Orissa
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A. Shankaran

Poona
G. T. Gokhale
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Punjab
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G. C. Khanna

Rajasthan
K. N. Bhargava
T. M. Desai

Uttar Pradesh
B. D. Goyal
S. P. Sinha

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K. C. Banerjee
Dildar Husain
V. G. Garde
Prof. N. S. Govinda Rao
Brig. P. R. Kumar

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Dr. T. Sen

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K. Barua (*Assam*)
S. Bandopadhyaya (*Bengal*)
D. Mookerjea (*Bihar*)
J. G. Bodhe (*Bombay*)
Maj.-Gen. S. P. Vohra (*Delhi*)
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V. Ranganathan (*Kerala*)

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Jatindra Singh (*Punjab*)
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K. N. Misra (*Uttar Pradesh*)

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T. R. Gupta (*Mechanical*)

Prof. M. V. Deshpande* (*Electrical*)
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G. A. Narasimha Rao

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K. N. Misra*
A. C. Mitra
R. D. Varma

Secretary

B. Seshadri

---

* Names repeated

CALCUTT

THE BULLETIN

OF

The Institution of Engineers (India)

SECRETARY & EDITOR: B. SESHADRI, B.Sc., A.I.I.Sc., D.I.C., M.Sc.(Eng.), M.I.E.

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THE BULLETIN
OF
The Institution of Engineers (India)

SECRETARY & EDITOR: B. Seshadri, B.Sc., A.I.I.Sc., D.I.C., M.Sc.(Eng.), M.I.E.

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THE INSTITUTION OF ENGINEERS (INDIA)

8 Gokhale Road, Calcutta 20

NOTICE OF MEETING OF CORPORATE MEMBERS UNDER BYE-LAW 77

Dated September 25, 1963

NOTICE is hereby given that a Meeting of the Corporate Members of the Institution will be held at 8 Gokhale Road, Calcutta 20, on Saturday, the 19th day of October, 1963, at 4.30 p.m., for the following purpose :

To consider revisions to the Bye-laws which have been proposed by the Council of the Institution, and which have been recommended by the Council to the Corporate Members of the Institution at their 430th Meeting held in Trivandrum on 24th and 25th August, 1963, as follows :

1. Proposed that the existing Bye-laws of the Institution be amended as shown in the Schedule annexed to the Notice of the Meeting.

By order of the Council
B. Seshadri
Secretary

N.B.—If you are unable to attend the Meeting personally, please fill up the accompanying Form of Proxy with the name of some person whom you think fit to appoint as your Proxy. Please sign the Proxy Form on a revenue stamp of twenty nP. and return the Form to the Secretary, The Institution of Engineers (India), 8 Gokhale Road, Calcutta 20, on or before 5 p.m. on the 16th October, 1963.

Please see Form of Proxy at the end of the Bye-Laws.

BYE-LAWS

Preliminary

1. *Interpretation :* In these Bye-Laws, unless the context otherwise requires, expressions shall have the same respective meaning as in the Charter, and words importing the singular shall include the plural, masculine shall include feminine and *vice versa,* and words importing persons shall include bodies corporate.

Furthermore, unless there be something repugnant to or inconsistent with the subject or context :

(a) 'The Bye-Laws' means the Bye-Laws of the Institution for the time being in force.

(b) 'The Charter' means the Royal Charter by which the Institution is incorporated.

(c) 'Chartered Engineer' means Corporate Member of the Institution.

(d) 'The Council' means the Council of the Institution constituted under these Bye-Laws.

(e) 'Chairman of Local Centre' means the Chairman of the Committee of a Local Centre.

(f) 'Division' means one of the Divisions of the Institution.

(g) 'Division Council' means the Council of a Division of the Institution.

(h) 'Executive Committee' means the Executive Committee of the Council constituted in accordance with these Bye-Laws.

(i) 'Financial Year' means the twelve months ending the 30th day of June of every year.

(j) 'The Institution' means the Institution of Engineers (India) incorporated by the Royal Charter 1935.

(k) 'The President' means the President of the Institution.

(l) 'The Regulations' means the Regulation of the Institution for the time being in force.

(m) 'The Secretary' means the Secretary or Secretaries of the Institution as may be appointed from time to time.

(n) 'Vice-President' and/or 'Chairman' means a Vice-President of the Institution who is also a Chairman of a Division of the Institution.

BYE-LAWS

of

The Institution of Engineers (India) incorporated by a grant of Royal Charter in the year 1935 for the general advancement of engineering science.

INTERPRETATIONS

1. In these Bye-Laws, unless the context otherwise requires, expressions shall have the same meaning as in the Charter, words importing males shall include females and words implying the singular number shall include the plural number, and *vice versa,* and words importing individual person or persons shall include body or bodies corporate.

Furthermore,

(a) 'The Institution' means The Institution of Engineers (India) incorporated by Royal Charter dated 9th September, 1935.

(b) 'The Charter' means the Royal Charter of The Institution dated 9th September, 1935.

(c) 'The Bye-Laws' means the Bye-laws of the Institution for the time being in force.

(d) 'The Council' means the Council of the Institution constituted under these Bye-Laws.

(e) 'The President' means the President of the Institution.

(f) 'Division Board' means the Board of a Division of the Institution.

(g) 'The Secretary' means the Secretary of the Institution as may be appointed by the Council from time to time.

(h) 'Financial Year' means the twelve months commencing the 1st day of September of a year and ending the 31st day of August of the following year.

(i) 'Session' means the period of time between the date of one Annual General Meeting and the date of the succeeding Annual General Meeting.

(j) 'The Roll' means the register of members of the Institution.

(k) 'Recorded Address' means the address of a member as given in the proposal for his election or transfer, or subsequently varied by notice in writing to the Secretary and as recorded in the Roll.

(l) For the purposes of these Bye-laws, a person shall be deemed not to have attained any particular age until the commencement of the corresponding anniversary of the day of his birth notwithstanding any rule to the contrary.

(m) 'Regulations' means the Regulations of the Council for the time being in force, made pursuant to Bye-law 73.

2. *Headquarters of the Institution :* The Headquarters of the Institution shall be situated in Calcutta. The Headquarters can be shifted to any other place as may be decided by the two-thirds majority of Corporate Members on the Roll by postal ballot.

Local Centres

3. (a) The Council may establish Local Centres of the Institution at different places in India with defined geographical boundaries and entrust to such Local Centres such functions as the Council may prescribe from time to time depending upon the strength of the membership in the various Divisions at the Local Centres concerned.

(b) The Council may entrust certain functions collectively to two or more Local Centres as it may deem fit in the interests of the Institution.

(c) The Council may establish Sub-Centres within the geographical boundaries of a Local Centre with such functions as the Council may prescribe from time to time.

(d) The Council shall frame Regulations and may amend them from time to time in regard to the formation of Local Centres and Sub-Centres, and for the management of the Local Centres and Sub-Centres singly or collectively for such functions as the Council may prescribe from time to time.

Members and Attached Persons

5. There shall be the following classes of members of the Institution :

(a) Members, Honoris Causa
  Honorary Members
  Honorary Life Members

(b) Corporate Members (Chartered Engineers)
  Members
  Associate Members

(c) Non-Corporate Members
  Companions
  Graduates

The respective classes of members shall be elected as prescribed in the Bye-Laws and the Regulations.

6. There shall be the following classes of attached persons and bodies in the Institution :

(a) Students
(b) Subscribers
(c) Technicians

Students, Subscribers and Technicians shall be attached to the Institution as prescribed in the Bye-Laws and the Regulations.

HEADQUARTERS

2. The Headquarters of the Institution shall be situated in Calcutta. The Headquarters may be shifted to any other place as may be decided by the two-thirds majority of Corporate Members on the Roll by postal ballot.

LOCAL CENTRES

3. The Council shall establish one Centre of the Institution in each State of the Indian Union referred to in these Bye-laws and to be known as Local Centre. This provision of one Local Centre in a State shall not, however, apply to the State where there are already in existence more than one Local Centre. Each Local Centre shall be constituted and its affairs shall be carried on in accordance with the provisions laid down in the Regulations and such other rules made from time to time by the Council.

4. The Council may establish one or more Sub-Centres of the Institution within the geographical boundaries of a Local Centre. The affairs of such Sub-Centres shall be carried on, and each such Sub-Centre shall have due representation in the Local Centre, in accordance with the provisions laid down in the Regulations and such other rules made from time to time by the Council.

MEMBERSHIP

5. The Institution shall consist of members in the following orders : Honorary, Corporate and Non-Corporate. The Honorary order shall comprise the classes of Honorary Members, Honorary Life Members and Fellows. Corporate Members shall comprise the classes of Members and Associate Members and Non-Corporate Members shall comprise the classes of Companions, Affiliate Members, Graduates, Students and Subscribers. The names and addresses of all classes of members shall be entered on the Roll of the Institution.

MANAGEMENT

6. The Council shall exercise all the powers of the Institution and control, govern, do and discharge all the affairs and duties of the Institution with intent to give effect to the provisions of the Charter and the Bye-laws for the time being of the Institution except so far as the same are by the Charter or by the Bye-laws for the time being expressly required to be done in General Meetings of Corporate Members or by the President or the Secretary of the Institution. The Council shall be competent to make any delegation of its said powers or duties to the President or the Secretary.

Divisions

4. (a) Unless and until the Council shall otherwise direct, for the attainment of the objects of the Institution in the main branches of engineering, the Institution shall have the following Divisions designated as under :

1. Civil Engineering Division
2. Mechanical Engineering Division
3. Electrical Engineering Division
4. Mining and Metallurgy Division
5. Electronics and Telecommunication Engineering Division
6. Chemical Engineering Division
7. General Engineering Division

The General Engineering Division shall include all branches of engineering not covered by the other Divisions.

(b) The Council may form new Divisions when the number of Corporate Members in a main branch of engineering is not less than 500. This requirement will not however apply to the Divisions already named above.

7. (a) Existing Corporate Members as on the date of coming into effect of these Bye-Laws shall be attached to one or more Divisions as per their choice subject to requisite qualifications and experience, and the decision of the Council in this behalf shall be final.

(b) Candidates for election as Corporate Members after the coming into force of these Bye-Laws shall on election be attached to one or more Divisions according to their qualifications and experience, and the decision of the Council in this behalf shall be final.

8. Honorary Members and Honorary Life Members shall be Honorary Members and Honorary Life Members of the Institution in all its Divisions.

9. Companions, Graduates, Students and Subscribers shall not be attached according to Divisions.

10. Technicians may be classified according to their trades.

11. *Honorary Members :* The President of the Indian Republic, the Prime Minister of India, and Governors of States or equivalent Heads of States shall be declared elected as Honorary Members for the tenure of their office by the President on behalf of the Council after obtaining their consent. The Council shall frame rules in regard to the manner of bestowing the Honorary Membership on these high dignitaries.

12. *Honorary Life Members :* The Council may bestow the honour of Honorary Life Membership on such eminent engineers in India and abroad as have highly distinguished themselves in the engineering profession. The number of such Honorary

DIVISIONS

7. The Institution shall have the following Divisions of Engineering for promoting the study of the respective branches of engineering :

(i) Civil Engineering Division
(ii) Mechanical Engineering Division
(iii) Electrical Engineering Division
(iv) Mining and Metallurgy Division
(v) Electronics and Telecommunication Engineering Division
(vi) Chemical Engineering Division
(vii) Public Health Engineering Division

8. The Council may establish, in addition to the Divisions mentioned in Bye-law 7, other Divisions for promoting the study of any particular branches of engineering provided that Corporate Members not less than 500 in number specially qualified in any proposed new Division seek the establishment of such a Division.

9. The existing Groups of Engineering and such other Groups of Engineering which the Council may establish shall work within the appropriate Divisions as may be decided by the Council.

10. Corporate Members and Graduates shall be attached to one Division only based on their educational qualifications approved by the Council at the time of their admission to the Institution, but if so qualified for attachment to more than one Division, a Corporate Member and a Graduate shall be allowed to select and change to the Division to which he would like to be attached. The Council may, however, at their discretion, allow the transfer of a Corporate Member or Graduate from one Division to another provided he establishes to their satisfaction that he deserves such transfer on account of change in the field of his practice of engineering subsequent to his election as a Corporate Member.

Corporate Members and Graduates may take part in the technical activities of one or more Divisions other than their own in accordance with rules made from time to time by the Council.

11. Companions, Affiliate Members, Students and Subscribers shall not be attached to any of the Divisions.

QUALIFICATIONS FOR MEMBERSHIP

Honorary Members

12. Honorary Members shall be the President of India, the Vice-President of India, the Prime Minister of India, and Governors of States or equivalent Heads of States as may be invited by the Council to be Honorary Members for the period of their tenure of office.

Honorary Life Members

13. Honorary Life Members shall be elected by the Council from persons in India and abroad for their high eminence in engineering, and every such election shall be

Life Members from India shall not exceed ten and the number of such Honorary Life Members from other countries shall not exceed twenty. The Council shall frame rules for the election of such Honorary Life Members and in regard to the manner of bestowing the honour on them.

13. *Members :* Every candidate for admission to the Institution as a Member or for transfer from Associate Member to Member, shall produce evidence satisfactory to the Council that he complies with the following conditions :

(1) Age—He shall be not less than thirty-five years of age.

(2) Occupation—He shall be engaged in the profession of engineering in a position of high responsibility, or shall have retired from the profession after having held, before his application for election or transfer, a position of high responsibility.

(3) Attainments—He shall have attainments by virtue of his educational qualifications and/or experience which will comply with one of the following alternative conditions :

(A)(a) He shall either be an Associate Member or shall have fulfilled the conditions necessary for Associate Membership ; and

(b) He shall have had at least five years' experience in a position of responsibility in the design and/or execution of important engineering works and/or teaching in engineering and/or research in engineering.

(B) He shall have had experience in a position of responsibility as laid down in (A)(b) above for a period of not less than fifteen years.

(C) He shall have been an Associate Member for a continuous period of fifteen years prior to the date of his application for transfer to Member.

announced at the next Annual General Meeting, provided that there shall not be more than fifteen Honorary Life Members at any one time.

Fellows

14. Fellows shall be elected by the Council from persons in India and abroad for their outstanding contributions to sciences connected with the theory and practice of engineering or their outstanding services rendered to the prosecution of engineering works, and every such election shall be announced at the next Annual General Meeting.

Members

15. Every candidate for election as a Member or for transfer from Associate Member to Member shall satisfy the Council that he possesses the following qualifications :

(i) Age : He shall have attained the age of thirty-five years on the date of his application for election or transfer.

(ii) Occupation : He shall be engaged in the profession of engineering in a position of high responsibility, or shall have retired from the profession after having held, before his application for election or transfer, a position of high responsibility.

(iii) Attainments : He shall have one of the following qualifications lettered respectively (a) or (b) or (c) :

(a) He shall either be an Associate Member or shall have fulfilled the conditions necessary for Associate Membership ; and he shall have had at least twelve years' employment in the aggregate in a position of full responsibility in the design or execution of important engineering works.

For the purpose of this Bye-law, employment as a senior member of the engineering staff in an engineering college or institute which has regular courses of study leading to an educational qualification recognized by the Council as exempting from Sections A and B of the Associate Membership Examination, or employment in a responsible position on important engineering research may be accepted by the Council in place of employment in the design or execution of important engineering works.

(b) He shall have had at least fifteen years' employment on the aggregate in a position of responsibility as described in Bye-law 15 (iii)(a).

(c) He shall have high educational qualifications, and shall occupy a prominent position in the profession of engineering to the satisfaction of the Council.

14. *Associate Members :* Every candidate for admission to the Institution as an Associate Member or for transfer from Graduate or Student to Associate Member shall produce evidence satisfactory to the Council that he complies with the following conditions :

(1) Age—He shall be not less than twenty-five years of age.

(2) Occupation—He shall have been engaged in the design and/or execution and/or operation of engineering works and/or teaching in engineering and/or research in engineering in a position of responsibility.

(3)(a) Examinations—He shall have passed Sections A and B Examination for Associate Membership prescribed by the Council or such other examination or examinations as are recognized by the Council as exempting therefrom.

(b) He may be further required to appear for a written and/or oral test or produce evidence of his experience by a report or dissertation on the work done by him. The Council may in its discretion dispense with this requirement in appropriate cases.

(4) Training and Experience—He shall have further received engineering training and practical experience (which includes teaching and research in engineering) for a total period of not less than seven years which shall include a period of not more than three years as a Student of the Institution or as a student or trainee or pupil or apprentice in an engineering college or institution or in an engineering office or works to the satisfaction of the Council.

A Graduate of the Institution of a standing of more than five years or such period as the Council may prescribe from time to time shall be considered to have satisfied the requirements of Bye-Laws 14(3) and 14(4).

15. *Companions :* Every candidate for admission to the Institution as a Companion shall be not less than thirty-three years of age, and shall be a person, who though not an engineer by profession, yet by reason of his attainments in science or in any of the

Associate Members

16. Every candidate for election as an Associate Member or for transfer from Graduate or Student to Associate Member shall satisfy the Council that he possesses the following qualifications :

(i) Age : He shall have attained the age of twenty-five years on the date of his application for election or transfer.

(ii) Occupation : He shall have been engaged in a position of responsibility in the design and execution or operation of engineering works.

For the purpose of this Bye-law, employment as a teacher of engineering or in a likewise capacity in an engineering college or institute which has regular courses of study leading to an educational qualification recognized by the Council as exempting from Sections A and B of the Associate Membership Examination, or employment in engineering research may be accepted by the Council in place of employment in the design and execution or operation of engineering works.

(iii) Examinations : He shall have passed Sections A and B of the Associate Membership Examination prescribed by the Council or possess an educational qualification recognized by the Council as exempting therefrom.

(iv) Training : He shall have received engineering training in a regular course of study in an engineering college or institute leading to an educational qualification recognized by the Council as exempting from Sections A and B of the Associate Membership Examination, or as a pupil or apprentice or assistant in an engineering office or works as would provide him with engineering training to the satisfaction of the Council.

(v) Experience : He shall have had further at least four years' professional engineering experience in a position of responsibility. In the case of a candidate who has passed Sections A and B of the Associate Membership Examination, the Council may, at their discretion, take into account periods of responsible employment prior to his passing Section B.

The Council may, at their discretion, arrange for candidates for election as Associate Members to be examined by a written or an oral test or both called Section C of the Associate Membership Examination in order that they may be satisfied that such candidates have acquired during their practical training and professional engineering experience adequate engineering knowledge.

Companions

17. Every candidate for election as a Companion shall have attained the age of thirty-five years on the date of his application for election. Not being an engineer by profession

arts allied to or having interests in common with engineering, may be deemed by the Council to be worthy of the distinction of being elected a Companion.

16. *Graduates :* Every candidate for admission to the Institution as a Graduate, or for transfer from Student to Gradute, shall produce evidence satisfactory to the Council that he complies with the following conditions :

(1) Age—He shall be not less than twenty-one years of age. No person shall remain a Graduate after the completion of his fortieth year.

(2) Occupation—He shall be actually engaged in engineering work at the time of his application for election and shall, in the opinion of the Council, be making satisfactory progress in the acquisition of qualifications for Associate Membership.

(3) Examinations—He shall have passed Sections A and B Examination for Associate Membership or such other examination or examinations as are recognized by the Council as exempting therefrom.

(4) Training—He shall be receiving or have received such regular training as an engineer as would, in due course, fit him for responsible employment as an engineer.

17. *Students :* Every candidate for attachment to the Institution as a Student shall be a person not less than seventeen years of age who is qualifying himself for the profession of an engineer as a pupil, apprentice or assistant under a Corporate Member, or being trained in a recognized engineering institution, or is obtaining training and experience in a manner approved by the Council. He shall have passed an examination for Studentship prescribed by the Council or such other examination or examinations as are recognized by the Council as exempting therefrom. The Council may call for such reports from a Student in regard to the work in which he is engaged as it may consider necessary, and failure to submit such reports to the satisfaction of the Council shall be adequate reason for discontinuing his attachment.

he shall satisfy the Council that he occupies a position of high responsibility in a profession, science or industry having interests in relation to engineering, or has rendered important services to engineering.

Affiliate Members

18. Every candidate for election as an Affiliate Member shall have attained the age of twenty-five years on the date of his application. Not being qualified for Corporate Membership, he shall satisfy the Council that he holds a position of responsibility related to engineering.

Graduates

19. Every candidate for election as a Graduate or for transfer from Student to Graduate shall satisfy the Council that he possesses the following qualifications:

- (i) Age: He shall have attained the age of twenty-one years on the date of his application for election or transfer.
- (ii) Occupation: He shall be engaged in the engineering profession and shall, in the opinion of the Council, be making satisfactory progress in the acquisition of qualifications for Associate Membership, provided that temporary unemployment is no bar to his election.
- (iii) Examinations: He shall have passed Sections A and B of the Associate Membership Examination prescribed by the Council or possess an educational qualification recognized by the Council as exempting therefrom.
- (iv) Training: He shall have received engineering training in a regular course of study in an engineering college or institute leading to an educational qualification recognized by the Council as exempting from Sections A and B of the Associate Membership Examination, or as a pupil or apprentice or assistant in an engineering office or works as would provide him with engineering training to the satisfaction of the Council.

Students

20. Every candidate for election as a Student who has passed the Studentship Examination prescribed by the Council or possesses an educational qualification recognized by the Council as exempting therefrom shall have attained the age of sixteen years on the date of his application for election. He shall be qualifying himself for the profession of an engineer as a pupil or apprentice or assistant under a Corporate Member, or receiving training in an engineering college or institute leading to an educational qualification recognized by the Council, or obtaining training in any other manner approved by the Council. The Council may call for such reports from a Student in regard to the work in which he is engaged as they may consider necessary, and failure to submit such reports to the satisfaction of the Council shall be adequate reason to annul his election.

18. *Subscribers:* The Council may, at its discretion, attach to the Institution as a Subscriber any State, Department of Government, Public Body, Registered Company, Firm or individual, not eligible to be a Member, Associate Member or Companion, who may desire to be so attached. Each Subscriber shall be entitled to attend (or if the Subscriber be other than an individual) to depute a representative, not being a person eligible for election as a Corporate Member to attend the Ordinary General Meetings and Ordinary General Professional Meetings.

19. *Technicians:* Every candidate for attachment to the Institution as a Technician shall produce evidence satisfactory to the Council that he complies with the following conditions:

(1) Age—He shall be not less than twenty-one years of age.

(2) Occupation—He shall be actually engaged in the position of a supervisor or foreman or other equivalent position in the design and/or execution of engineering works and/or operation of engineering works and/or teaching of engineering techniques and/or assisting in engineering research.

(3) Examination—He shall have passed an examination for Technicians prescribed by the Council or such other examination or examinations as are recognized by the Council as exempting therefrom.

(4) Training—He shall have received regular training to the satisfaction of the Council as would in due course fit him for employment as a supervisor or foreman or other equivalent position.

Election of Members and Attached Persons

20. Any person desirous of being elected a Member or Associate Member or being transferred from Associate Member to Member shall be proposed and recommended by his supporters from personal knowledge according to the provisions and the appropriate form prescribed in the Regulations.

21. Any person desirous of being elected a Companion shall be proposed and recommended by his supporters from personal knowledge according to the provisions and the appropriate form prescribed in the Regulations.

22. Any person desirous of being elected a Graduate shall be proposed and recommended by his supporters from personal knowledge according to the provisions and the appropriate form prescribed in the Regulations.

23. Any person desirous of being attached as a Student shall be proposed and recommended by his supporters from personal knowledge according to the provisions and the appropriate form prescribed in the Regulations.

24. Any person desirous of being attached as a Technician shall be proposed and recommended by his supporters from personal knowledge according to the provisions and the appropriate form prescribed in the Regulations.

Subscribers

21. The Council may, at their discretion, attach to the Institution as a Subscriber any Public or Local Body, Registered Company or Firm, or an individual who may desire to be so attached.

ELECTION AND TRANSFER

22. Any person desirous of election as a Member or Associate Member or Companion, or transfer from Associate Member to Member, or from Graduate or Student to Associate Member, shall be proposed and recommended from personal knowledge in the prescribed form by six Corporate Members, of whom at least three shall be Members. The proposal form shall be accompanied by such fees as are prescribed in the Regulations, and shall be delivered to the Secretary.

23. Any person desirous of election as an Affiliate Member or Graduate, or transfer from Student to Graduate, shall be proposed and recommended from personal knowledge in the prescribed form by four Corporate Members, of whom at least two shall be Members. The proposal form shall be accompanied by such fees as are prescribed in the Regulations, and shall be delivered to the Secretary.

24. Any person desirous of election as a Student shall be proposed and recommended from personal knowledge in the prescribed form by two Corporate Members. The proposal shall be accompanied by such fees as are prescribed in the Regulations, and shall be delivered to the Secretary.

25. Any applicant desirous of attachment as Subscriber shall deliver his application direct to the Secretary, with such fees as are prescribed in the Regulations.

25. A candidate applying under Bye-Laws 20, 21, 22, 23 and 24 shall give sufficient evidence to the satisfaction of the Council of the correctness of his statements made in the application form.

26. Each proposal form completed as required by the Regulations in relation to Member, Associate Member, Companion, Graduate, Student or Technician shall be submitted to the Secretary with such application fee as may be specified by the Council from time to time.

27. (a) On each proposal form for Corporate Member, the Secretary shall annex thereto his remarks as to whether or not the qualifications of the candidate appear to be in accordance with the provisions of the Bye-Laws ;

(b) The Secretary shall then forward the proposal form with his note aforesaid for remarks to the Honorary Secretary of the Local Centre within the boundaries of which the candidate resides or practises or carries on business ;

(c) The Honorary Secretary of the Local Centre shall obtain the opinion of the Committee of the Local Centre, record it in the space set apart for the purpose, and return it to the Secretary;

(d) The Secretary shall then forward the proposal form to the Chairman of the Division Council concerned for his recommendation;

(e) If the Chairman of the Division agrees with the recommendation of the Committee of the Local Centre in so far as the grade of Associate Member is concerned, he shall, on behalf of the Council, declare the proposal as approved by the Council or as not approved by the Council as the case may be ;

(f) In the following cases, however, the Secretary shall take a postal vote of the Council :

(i) In case the Chairman of the Division Council differs from the recommendation made by the Committee of the Local Centre.

(ii) In case the recommendation made by the Committee of the Local Centre and the Chairman of the Division Council is for the grade of Member.

(iii) In case of transfer from Associate Member to Member.

In scrutinizing the result of the postal ballot, each negative vote shall be taken as equivalent to one positive vote. The Secretary shall then, on behalf of the Council, declare the proposal as approved by the Council or as not approved by the Council as the case may be.

28. (a) On each proposal form for Companion, Graduate and Student, the Secretary shall annex thereto his remarks as to whether or not the qualifications of the candidate appear to be in accordance with the provisions of the Bye-Laws ;

(b) The Secretary shall then forward the proposal form with his note aforesaid for remarks to the Honorary Secretary of the Local Centre within the boundaries of which the candidate resides or practises or carries on business ;

26. (a) On each proposal form from an applicant normally resident in India, for Corporate Member or Companion or Affiliate Member, the Secretary shall record his opinion as to whether or not the qualifications of the candidate appear to be in accordance with the provisons of the appropriate Bye-law ;

(b) The Secretary shall then forward the proposal form with his note aforesaid to the Honorary Secretary of the Local Centre within the boundaries of which the candidate resides or practices or carries on business ;

(c) The Honorary Secretary of the Local Centre shall obtain the opinion of the Committee of the Local Centre, record it on the aforesaid note of the Secretary in the space set apart for this purpose, and return it to the Secretary ;

(d) The Secretary shall then forward the proposal form to the President for his opinion, except when the opinion given by the Committee of the Local Centre is for election to the class of Member ;

(e) If the opinion of the President agrees with the opinion of the Committee of the Local Centre, the Secretary shall then, on behalf of the Council, declare the proposal as approved by the Council or as not approved by the Council as the case may be ;

(f) If the opinion of the President is not in accord with the opinion of the Committee of the Local Centre, the Secretary shall take a postal vote of the Council ; in scrutinizing the result of the postal vote, one negative vote shall be taken as equivalent to two positive votes ; except that in the case where the opinion recorded by the Local Centre is for election to the class of Member, votes cast for Associate Member shall be taken as negative votes, and in the case where the opinion recorded by the Local Centre is for election to the class of Associate Member, votes for Member shall be taken as positive votes ; the Secretary shall then, on the result of the postal vote and on behalf of the Council, declare the proposal as approved by the Council or as not approved by the Council as the case may be ; and

(g) Where the opinion recorded by the Committee of the Local Centre is for election to the class of Member, the Secretary shall also take a postal vote of the Council ; and declare the result as in Bye-law 26(f).

27. (a) On each proposal form from an applicant normally resident abroad, for Corporate Member or Companion or Affiliate Member, the Secretary shall record his opinion as to whether or not the qualifications of the candidate appear to be in accordance with the provisions of the appropriate Bye-law ;

(b) The Secretary shall then forward the proposal form to the President for his opinion, except when the opinion recorded by him is for election to the class of Member ;

(c) If the opinion of the President agrees with the opinion of the Secretary, the Secretary shall then, on behalf of the Council, declare the proposal as approved by the Council or as not approved by the Council as the case may be ;

(c) The Honorary Secretary of the Local Centre shall obtain the opinion of the Committee of the Local Centre, record it in the space set apart for the purpose, and return it to the Secretary ;

(d) The Secretary shall then, on behalf of the Council, accept the recommendation of the Committee of the Local Centre, and declare the proposal as approved by the Council or as not approved by the Council as the case may be ;

(e) In case of any difference of opinion at any of the above stages, the Secretary shall, however, take a postal vote of the Council thereon.

The postal vote shall be scrutinized by the Secretary in the same manner as in Bye-Law 27, and he shall then, on behalf of the Council, declare the proposal as approved by the Council or as not approved by the Council as the case may be.

29. Proposal forms for Technician, after their receipt by the Secretary, shall be processed according to the manner prescribed in the Regulations.

30. Every candidate for the grade of Member or Associate Member on his election or transfer shall be forthwith notified of the fact by the Secretary in accordance with the appropriate form prescribed in the Regulations.

31. Every candidate for the grade of Companion, Graduate, Student or Technician on his attachment shall be forthwith notified of the fact by the Secretary in accordance with the appropriate form prescribed in the Regultions.

32. The Secretary shall give notice of every such election or attachment to the Honorary Secretary of the Local Centre within the boundaries of which the candidate resides or practises or carries on business.

(d) When the opinion recorded by the Secretary is for election to the class of Member, the Secretary shall take a postal vote of the Council; and declare the result as in Bye-law 26(f).

28. (a) Each proposal form for Graduate or Student shall be scrutinized by the Secretary as to whether or not the qualifications of the candidate are in accordance with the appropriate Bye-laws;

(b) The Secretary shall then, on behalf of the Council, declare the proposal as approved or not approved by the Council as the case may be;

(c) If the candidate has the requisite educational qualification but the nature of his training is such as can be best verified by the Local Centre within the boundaries of which he resides, the Secretary shall follow the procedure set out in Bye-law 26(a), (b), (c), (d), (e) and (f).

29. (a) Each proposal form for Subscriber shall be scrutinized by the Secretary as to whether or not it is desirable to attach the applicant as a Subscriber to the Institution;

(b) If the applicant, in the opinion of the Secretary, is suitable, the Secretary shall, on behalf of the Council, declare the proposal as duly approved by the Council, or if not suitable, as not approved by the Council.

30. Every candidate for the class of Member, Associate Member, Companion, Affiliate Member, Graduate or Student shall, on his election or transfer, be forthwith notified of the fact by the Secretary. But no person, although duly elected in accordance with the Bye-laws shall be entitled to any of the rights and privileges of the Institution, nor shall his name be entered on the Roll, until he shall have signed and delivered to the Secretary an undertaking in the prescribed form that he will be governed by the provisions of the Bye-laws and the Regulations in force from time to time and that he will accept as final and binding the decisions of the Council.

31. Every applicant for the class of Subscriber shall, on his attachment, be forthwith notified of the fact by the Secretary.

32. The Secretary shall give notice of every such election or attachment to the Honorary Secretary of the Local Centre within the boundaries of which the candidate or applicant resides or practises or carries on business.

EXAMINATIONS

33. The Council shall cause an Associate Membership Examination in Sections A and B to be held for election as Associate Members or Graduates and a Studentship Examination to be held for election as Students in the cases in which such examination is or may be required. Further, the Council shall also cause to be held Section C of the Associate Membership Examination for the purpose stated in Bye-law 16(v).

34. The Council shall frame rules for such examinations, define the times and places at which they shall be held, the subjects which they shall comprise, the fees to be paid by candidates in respect of such examinations, and the conditions under which the candidates may be admitted thereto. The Council shall have power from time to time to vary or rescind any such rules.

Rights and Privileges

33. Subject to the provisions of the Charter and to the restrictions contained in the Bye-Laws :

(a) Honorary Life Members and Members shall enjoy all the rights and privileges of the Institution.

(b) Associate Members shall enjoy the rights and privileges of the Institution save only that they shall not be eligible to hold office as President or Vice-President/Chairman of a Division or Chairman of a Local Centre.

(c) Companions, Graduates, Students and Technicians shall enjoy the rights and privileges of the Institution save that they shall not be eligible to hold any office and shall not have any right of voting.

34. The rights and privileges of every Honorary Life Member, Member, Associate Member, Companion, Graduate, Student and Technician shall be personal to himself and shall not be transmissible by his own act or by operation of law.

35. Honorary Life Members, Members, Associate Members, Companions, Graduates, Students, Subscribers and Technicians who are or may become subjects of any Foreign State shall cease to belong to the Institution on the declaration of a state of war between that Foreign State of which they are subjects and India, and on such declaration their names shall be removed from the Roll of the Institution and they shall not be eligible for re-election so long as such state of war shall continue.

35. The Council shall cause an Examinations Committee to be appointed, and shall frame rules for the constitution and election of such a Committee, and shall define the powers and functions of the Committee. The Council shall have power from time to time to add to, vary or rescind any such rules.

36. The Council shall have power to recognize such university degrees and collegiate or other diplomas or certificates as after scrutiny they may deem to prove a sufficient standard of attainment in the subjects referred to; and may exempt such graduates or holders of such diplomas or certificates from passing in whole or in part the aforesaid examinations appointed and directed by the Council.

RIGHTS AND PRIVILEGES

37. Subject to the provisions of the Charter and to the restrictions contained in the Bye-laws:

(a) Honorary Life Members shall enjoy all the rights and privileges of the Institution.

(b) Members shall enjoy all the rights and privileges of the Institution, but in accordance with the provisions in the Bye-laws and the Regulations.

(c) Associate Members shall enjoy the rights and privileges of the Institution, but in accordance with the provisions in the Bye-laws and the Regulations and save that they shall not be eligible to hold office as President or Chairman of a Local Centre or Sub-Centre or Chairman of a Division.

(d) Companions, Affiliate Members, Graduates and Students shall enjoy the rights and privileges of the Institution, but in accordance with the provisions in the Bye-laws and the Regulations and save that they shall not be eligible to hold any office and shall not have any right of voting.

38. The rights and privileges of every Honorary Life Member, Member, Associate Member, Companion, Affiliate Member, Graduate or Student shall be personal to himself as such and shall not be transmissible by his own act or by operation of law.

39. (i) Every Member and Associated Member is, and is entitled to describe himself as, a Chartered Engineer, and in using that description after his name, shall place it after the designation of the class in the Institution to which he belongs, stated in accordance with the following abbreviated forms, namely, M.I.E., A.M.I.E.

(ii) A Member or Associate Member practising in partnership with any person who is not a Member or Associate Member under the title of a firm shall not use or permit to be used after the title of such firm the designation Chartered Engineer or Chartered Engineers, or describe or permit the description of such firm in any way as Chartered Engineers.

(iii) A Member or Associate Member practising or acting in a professional capacity under the title of, or as a director, officer or employee of a company, whether such company shall be authorized or not to carry on the profession or business of an engineer in all or any of its branches, shall not use or permit to be used after the title of such

Expulsion and Disciplinary Action

36. (1) The Council shall have the right to expel from the Institution any Member Associate Member, Companion, Graduate, Student, Subscriber or Technician who shall have, in the opinion of the Council, wilfully acted in contravention of the Charter or the Bye-Laws or the Regulations from time to time in force under the Bye-Laws, or who, in the opinion of the Council, shall have been guilty of such conduct as shall render him unfit to belong to the Institution, provided that:

(a) The meeting of the Council at which the resolution shall be passed shall be specially convened for the purpose, and the person concerned shall have been given a clear thirty days' notice that his conduct is to be inquired into, and he is given an opportunity of stating his case to the Council;

(b) The resolution shall be passed by a majority of two-thirds of those present;

(c) The Council shall have the right to expel from the Institution such person who gets admission on wilful misrepresentation.

company the designation of Chartered Engineer or Chartered Engineers, or describe or permit the description of such company in any way as Chartered Engineers.

RESIGNATION, REMOVAL AND REINSTATEMENT

40. Every person elected to any class in the Institution shall be liable to the payment of his appropriate annual subscription until he shall have signified in writing to the Secretary his desire to resign, having previously paid all arrears including the current year's subscription, or until he has forfeited his right to remain in the Institution; provided that a letter of resignation may, with the consent of the Council, be cancelled at the request of the sender within six months of its receipt by the Secretary but on payment of all sums which he would have been liable to pay had his connection with the Institution not been interrupted. He shall thereupon recover all his former rights and privileges without re-election.

41. If any member of any class shall leave his subscription in arrear for two years, and shall fail to pay such arrears within three months after a notice has been sent to him by the Secretary, his name shall be removed from the Roll, and he shall thereupon cease to have any rights or privileges, but he shall nevertheless continue to be liable to pay the arrears of subscription due at the time of his name being removed from the Roll. The Diploma or Certificate of every such person shall be returned to the Secretary.

42. The Council may, if they find good reason to do so, reinstate on such conditions as they may seem fit, any person who has been a Member or Associate Member and whose name has been removed from the Roll on account of resignation or non-payment of subscriptions. These cases shall be considered and reported upon to the Council by a Committee appointed by the Council for the purpose.

EXPULSION AND DISCIPLINARY ACTION

43. (i) The Council shall have the right to expel from the Institution any member who shall have, in the opinion of the Council, wilfully acted in contravention of the Charter or the Bye-laws or the Regulations from time to time in force under the Bye-laws, or who, in the opinion of the Council, shall have been guilty of such conduct as shall render him unfit to remain a member of the Institution, provided that:

(a) The meeting of the Council at which the resolution shall be passed shall be specially convened for the purpose, and the person concerned shall have been given clear thirty days' notice that his conduct is to be inquired into, and is given an opportunity of stating his case to the Council;

(b) The resolution shall be passed by a majority of two-thirds of those present.

(ii) Upon a resolution of expulsion being passed, the name of the person concerned shall be removed from the Roll and he shall cease to have any connection with

(2) Upon a resolution of expulsion being passed, the person concerned shall cease to have any connection with the Institution. Neither the Council nor any one serving on the Council shall be liable for anything done under this Bye-Law. Every Corporate Member, Non-Corporate Member and Attached Person applying for admission to the Institution shall be deemed in so applying to agree to accept as final any decision of the Council under this Bye-Law.

(3) Every person so expelled shall be called upon by the Secretary to return immediately his Diploma or Certificate to the Secretary.

(4) The Council shall also have the right to take any disciplinary action against any Corporate Member, Non-Corporate Member or Attached Person. The procedure laid down above shall be followed in those cases also where the acts complained against may not warrant expulsion but may warrant some other disciplinary action. The decision of the Council shall be final and binding in such cases also.

The Council

37. The Council shall consist of the President, two immediate Past-Presidents, Chairman of the Local Centres during the period of their office, three Corporate Members from each Division who shall be elected by the Corporate Members of that Division on an all-India basis, and eighteen other Corporate Members who shall be elected by the Corporate Members of the Local Centres, the number of seats allotted to each Local Centre being proportional to the strength of Corporate Members at that Local Centre. The strength of the Council shall not exceed sixty-four.

All these elections shall take place by the method of proportional representation with a single transferable vote.

38. The Council shall elect the President from amongst the Members of the Council. The two immediate Past-Presidents shall not however be eligible for election as President. The eligibility of the President for re-election is defined under Bye-Law 39. The election of the President shall take place by the method of proportional representation with a single transferable vote.

39. The President shall retire at the Annual General Meeting of the Institution at the termination of his year of office but shall be eligible for re-election for a further period of office as President for one year only, but after completion of his period of office (of one year or two years as the case may be), he shall not be eligible for re-election until after a period of four years.

40. The President shall be *ex-officio* a member of all Committees of the Council and of all the Division Councils.

41. In the event of the President being unable to perform the duties of his office due to death, resignation or any other cause, or in the case of absence or leave until he reassumes charge after the expiry of leave, the senior Vice-President shall assume all the duties of the President until a new President is elected and has taken over charge at the

the Institution. Neither the Council collectively nor any member of the Council individually shall be made liable for anything done under this Bye-law. Every candidate applying for election to the Institution shall be deemed in so applying to agree to accept as final any decision of the Council under this Bye-law.

(iii) Every person who has ceased to belong to the Institution shall be called upon by the Secretary to return immediately his Diploma or Certificate to the Secretary, and he shall not be entitled any longer to make use of any designation implying past connection with the Institution.

44. The Council shall also have the right to take any disciplinary action against any member who shall have, in the opinion of the Council, acted in such a manner as to warrant disciplinary action but not expulsion. The procedure laid down in Bye-law 42(i) (a) and (b) shall be followed in such cases also, and the decision of the Council shall be final.

THE COUNCIL

45. The Council shall consist of the President; the two immediate Past-Presidents; the Chairmen of the Local Centres; a Corporate Member from each of the Local Centres who shall be elected by the Corporate Members of the respective Local Centres; additional Corporate Members from those Local Centres whose Corporate Membership exceeds one thousand such that one additional Corporate Member is elected for every additional one thousand Corporate Members or less; three Corporate Members from each of those Divisions to which are attached 500 or more Corporate Members elected by the Corporate Members of the respective Divisions; and two Corporate Members from each of those Divisions to which are attached less than 500 Corporate Members elected by the Corporate Members of the respective Divisions.

46. The President shall retire at the Annual General Meeting of the Institution at the termination of his session of office but shall be eligible for re-election for a further period of office as President for one session only, but after completion of his periods of office (of one session or two sessions as the case may be) he shall not be eligible for re-election.

47. The Council shall elect the President from amongst members of the Council excluding the immediate Past-Presidents and the Chairmen of the Local Centres.

48. The President shall be *ex-officio* a member of all committees of the Institution.

49. In the event of the President being unable to perform the duties of his office due to death, resignation or any other cause, or in the case of his prolonged absence for any reason, the seniormost member of the Council shall assume all the duties of the President. The seniority of members of the Council shall be based upon the continuous number of years that the members concerned have been on the Roll as Coporate Members.

50. Members of the Council elected from the Local Centres and the Divisions shall hold office for a period of four sessions.

Annual General Meeting. The seniority of the Vice-Presidents shall be based upon the continuous number of years that the Vice-Presidents concerned have been on the Roll of the Institution as Corporate Members.

42. The Chairmen of the Division Councils during the period of their office shall be *ipso facto* Vice-Presidents of the Council.

43. Members of the Council elected from the Divisions and the Local Centres shall hold office for a period of four years.

Election of the Council

50. The Secretary shall, before the 30th June preceding each Annual General Meeting, arrange to hold elections to fill vacancies in the Council from the Division on an all-India basis and at the Local Centres as required under Bye-Law 37. These elections shall take place by the method of proportional representation with a single transferable vote.

51. If there is any casual vacancy in the Council by death or resignation, the same shall be filled by the Council by co-option for the remaining term of that seat.

If there is any casual vacancy in the Council due to leave or absence of any Member of the Council, the same may be filled by the Council by co-option for the duration of the leave only.

52. If the Chairman of a Local Centre who is entitled to be a member of the Council during the period of his office is already a member of the Council, then in such a case the Local Centre concerned shall have the right of nominating one Corporate Member from that Centre as a Member of the Council during the period of office of the Chairman.

53. A Corporate Member shall not seek election to the Council from more than one constituency.

Divisions

44. Each Division of the Institution shall be managed by its own Division Council constituted in accordance with the Bye-Laws.

45. All Members of the Council belonging to a particular Division shall constitute the Division Council of that Division. If the number of members of any Division Council is less than four, then the Division Council may co-opt additional members so as to have four members on the Division Council including the Chairman. Such co-opted members shall not be members of the Council and shall also not be eligible for election as Chairman of the Division Council.

46. The Division Council of every Division shall elect a Chairman from amongst the members of the Division Council by the method of proportional representation with a single transferable vote. The Chairman of the Division Council shall retire at the Annual General Meeting of the Institution but shall be eligible for re-election for a further period of office as Chairman for one year only, but after completion of his period of office as Chairman (of one year or two years as the case may be), he shall not be eligible for re-election until after a period of three years. The Chairman of the Division

51. The Secretary shall, before the 31st August preceding each Annual General Meeting, notify the Honorary Secretary of each Local Centre of the number of members of Council who will retire at the Annual General Meeting, and shall call upon the Local Centre to hold an election under the appropriate Regulation to fill the vacancies in the Council.

52. The Council may fill by co-option any casual vacancy arising from death or resignation or any other cause of an elected member of the Council which may occur between one Annual General Meeting and the succeeding Annual General Meeting. The member of Council so appointed shall retire at the succeeding Annual General Meeting. Resignation from the Council, including resignation from Chairman of a Local Centre, shall become effective from the date of resignation, and shall not be withdrawn except by special permission of the Council.

53. If a Chairman of a Local Centre is already a member of the Council, then the Council may co-opt one Corporate Member from that Local Centre as a member of the Council during the period of office of the Chairman.

DIVISIONS

54. The affairs of each Division shall be carried on in accordance with the rules laid down from time to time by the Council. The Council shall have the power to vary the same as they may deem fit, subject always to the provisions of the Charter and the Bye-laws.

55. Members of the Council attached to particular Division shall constitute the Division Board of that Division, and shall elect a Chairman from amongst themselves. If the number of members in any Division Board is less than three, then that Division Board may co-opt additional members to make up that number. Such co-opted members shall not, however, be members of the Council.

56. The Chairman of the Divisions shall hold office as Chairman for a period of two sessions.

57. Any casual vacancy of Chairman of a Division arising from death or resignation or any other cause which may occur between one Annual General Meeting and the succeeding Annual General Meeting, shall be filled by the Council.

Council shall be *ex-officio* a member of all the committees of the Division. In the event of the Chairman being unable to perform the duties of his office due to death, resignation or any other cause, or in the case of absence or leave until he re-assumes charge after the expiry of leave, the Division Council shall appoint another Chairman from amongst the members of the Division Council.

47. In case any member of the Council belongs to more than one Division, he shall on election to the Council intimate the Secretary the name of the Division Council to which he elects to work. He shall not then have the right to be a member of any other Division Council.

48. The Division Councils of more than one Division may decide to act as a Joint Division Council during the term of the Division Councils concerned. Such decision shall be given effect to if the decision to that effect is taken separately by the respective Division Councils.

49. The Division Councils of the Divisions shall exercise such powers, functions and duties as the Council may delegate to them from time to time.

Secretary

54. A Secretary employed by the Institution shall by appointed and removed by the Council, who shall determine the length of the engagement, salary, powers and duties to be performed by him.

55. (1) The Secretary shall carry out all his duties under the direction of the Council. He shall, unless exempted from the provisions hereof by the Council devote his whole time to the business of the Institution and shall not engage in any other business or profession.

(2) He shall be responsible for all correspondence, accounts and office work of the Institution; he shall receive and transmit to the Bankers all funds and moneys paid to the Institution unless the Council shall appoint in his place for that purpose some other person; he shall attend all meetings of the Council and shall have the business thereat correctly and fully recorded and reported; he shall have charge of all the property of the Institution save only the funds and moneys in the custody of the Bankers; he shall maintain a Roll of the names of Honorary Members, Honorary Life Members, Members, Associate Members, Companions, Graduates, Students, Subscribers and Technicians and of their addresses; he shall direct the collection of subscriptions and other moneys due to the Institution; he shall engage (subject to the approval of the Council) and be responsible for all person employed under him and arrange their work and duties, and shall generally conduct the ordinary business of the Institution.

(3) The powers of the Secretary shall be specified in the Regulations, and may be modified by the Council from time to time.

SECRETARY

58. The Secretary of the Institution shall be appointed by the Council at such remuneration and on such other terms as they may think fit.

59. (i) The Secretary shall carry out all his duties under the direction of the Council. He shall, unless exempted from the provisions hereof by the Council, devote his whole time to the business of the Institution and shall not engage in any other business or profession. He shall be in administrative charge of all the employees at the Headquarters, Local Centres and Sub-Centres.

(ii) He shall be responsible for the conduct of all correspondence and office work of the Headquarters and the keeping of accounts of the Institution; he shall maintain a Roll of all classes of members and of their addresses; he shall attend all meetings of the Council and shall have the business thereat correctly and fully recorded and reported; he shall superintend the publications and the examinations of the Institution; he shall have charge of the libraries of the Institution; he shall have charge of all the properties of the Institution save only the funds and moneys in the custody of the Bankers; he shall engage, subject to the approval of the Council, all persons employed under him and arrange their work and duties; and he shall generally conduct the ordinary business of the Institution in accordance with the Charter, the Bye-laws, the Regulations and the directions of the Council, and shall refer to the President in any matters of importance or difficulty requiring urgent decision.

(iii) The powers of the Secretary shall be generally described in the Regulations, and may be varied by the Council from time to time.

Bankers

56. The Bankers of the Institution shall be the State Bank of India or one or more Scheduled Banks (as defined by Section 2 of the Reserve Bank of India Act of 1934) having head offices in the Indian Union as may be determined by the Executive Committee.

Auditors

57. (a) The Institution shall, at each Annual General Meeting appoint one or more properly qualified Auditor or Auditors to hold office until the next Annual General Meeting.

(b) A Member of the Council, a member of a Division Council, or officer of the Institution shall not be eligible of being appointed an Auditor of the Institution.

(c) The Council may fill any casual vacancy in the office of Auditor, but while any such vacancy continues, the surviving or continuing Auditor or Auditors (if any) may act.

(d) The remuneration of the Auditors of the Institution shall be fixed by the Institution at the Annual General Meeting at which they are appointed except that the remuneration of any Auditor appointed to fill any casual vacancy may be fixed by the Council.

Powers and duties of the Council

58. The government and control of the Institution and its affairs shall be vested in the Council. The Council shall exercise all powers of the Institution not otherwise specifically provided for and all powers which are necessary for attaining the objects of the Institution. In the government and control of the Institution and its affairs, the Council shall be subject to such directions (not being inconsistent with the provisions of the Charter or the Bye-Laws) of the Institution in General Meeting, but no such direction shall invalidate any prior act of the Council which would have been valid if that direction had not been given. The Council may delegate such of its powers to the following persons and bodies as it finds necessary from time to time.

(a) The Executive Committee of the Council.

(b) The Division Councils of the different Divisions.

(c) The President.

(d) The Vice-Presidents/Chairman of the Division.

(e) The Secretary.

(f) Such other person or persons or bodies as the Council may appoint or constitute from time to time for the efficient working of the Institution.

BANKERS

60. The Bankers of the Institution shall be the State Bank of India or one or more Scheduled Banks (as defined by Section 2 of the Reserve Bank of India Act of 1934) having head offices in the Indian Union as may be determined by the Council.

AUDITORS

61. (i) At each Annual General Meeting shall be appointed one or more properly qualified Auditor or Auditors to hold office until the next Annual General Meeting.

(ii) Every such Auditor or Auditors shall be a member of the Institute of Chartered Accountants of India, and shall hold a Certificate of Practice granted by that Institute.

(iii) The Council may fill any casual vacancy in the office of Auditor, but while any such vacancy continues the surviving of continuing Auditor or Auditors (if any) may act.

(iv) The remuneration of the Auditors shall be fixed at the Annual Genera Meeting at which they are appointed except that the remuneration of any Auditor appointed to fill any casual vacancy may be fixed by the Council.

POWERS, PROCEDURES AND DUTIES OF THE COUNCIL

62. Pending the making and approval of the Bye-laws at an Extraordinary General Meeting of Corporate Members specially called by the Council for this purpose, and pending the election of a Council according to the provisions of these Bye-laws, the existing Council shall be the Council of the Institution and shall exercise all powers of the Institution subject to the provisions of the Charter.

63. The Council shall direct and manage the affairs and property of the Institution, subject to the provisions of the Charter, the Bye-laws and the Resolutions of General Meetings of Corporate Members which have been duly summoned and held in accordance with the Charter and the Bye-laws and duly recorded in the minutes of the meetings. Subject as aforesaid, the Council shall further exercise all powers of the Institution not otherwise specifically provided for, provided such powers are not by the Charter or the Bye-laws required to be exercised by the Corporate Members in General Meeting.

64. The decisions of the Council on all matters dealt with by them in accordance with the provisions of the Charter, the Bye-laws and the Regulations, and such Resolutions as aforesaid, shall be final and binding on all classes of members.

65. The Council may appoint Committees and may delegate any of their powers to any such Committees except as stated in Bye-law 66. The Council may, in addition, delegate

59. In particular and without prejudice to the generality of the powers and duties exercisable by the Council, the Council shall have the following powers, duties and functions :

(a) To prescribe standards and conditions for admission into or attachment to the Institution.

(b) To frame and/or approve of Regulations not inconsistent with the Charter or the Bye-Laws for carrying out the objects of the Institution.

(c) To institute and confer diplomas, certificates and other distinctions for recognition of competence or extraordinary merit in engineering, trade, science or the profession, and to institute examinations.

(d) To arrange for the publications of the Institution.

(e) To cooperate with other bodies engaged in activities allied to engineering in such manner and for such purposes as the Council may determine.

(f) To define the functions, powers and duties of the Executive Committee, the Division Councils, the Secretary, the Local Centres, and other bodies and persons appointed or constituted for carrying out the objects of the Institution.

(g) To approve of the rules prepared by the Executive Committee and the Division Councils.

(h) To delegate any of its powers, functions and duties to any person or persons or bodies or committees as mentioned in the Bye-Laws.

(i) To amalgamate any other body or association of engineering and to elect or attach such of its members and others as the Council may decide to appropriate grades of Members and Attached Persons in the Institution.

(j) To exercise the power of overriding control on the administration of the Institution including the working of the Executive Committee, the Division Councils, the Secretary, the Local Centres, and other bodies and persons which may be constituted or appointed either by the Council or by any other authority on behalf of the Council.

Council Meetings

60. The Council shall meet not less than twice in a year. The notice of such meeting shall be given to each member of the Council together with the agenda not less than fourteen days before the date of the meeting. The period of fourteen days does not apply to supplementary agendas which may be issued as the exigencies of the case may require. This is subject to the proviso that only urgent matters as cannot wait till the next meeting of the Council shall be included in the supplementary agendas. Very urgent matters for which no notice is given may be taken at the meeting of the Council as a special case if the Council agrees that the matter is very urgent.

61. The Secretary shall summon, with the approval of the President, a special meeting of the Council on receipt of a requisition in writing signed by at least twenty members of

any of their powers to the President, the Chairmen of Local Centres, the Chairmen of the Divisions, the Secretary or such other person or persons or bodies as they may appoint or constitute from time to time for the efficient working of the Institution. All Committees or persons, shall, in the exercise of powers delegated to them by the Council and in the transaction of business, conform to any direction that may be given to them by the Council and subject thereto may regulate their proceedings as they think fit.

66. None of the powers or functions of the Council under Bye-laws 42 and 43 shall, however, be delegated to a Committee save only the hearing of any explanation or defence given orally.

67. The Council shall meet as often as the business of the Institution may require, but not less than four times a year. At every meeting of the Council ten members shall constitute a quorum. A meeting of the Council at which a quorum is present shall be competent to exercise all or any of the powers or discretions vested in or exercisable by the Council, notwithstanding any vacancy in the body. If at any meeting there is no quorum, the Council shall stand adjourned for twenty-four hours and shall meet at the same place and transact the business of the meeting, with the members present as the quorum.

68. To summon a meeting of the Council the Secretary shall issue the notice of meeting to each member of the Council together with the agenda not less than fourteen days before the date of the meeting. This period of fourteen days shall be exclusive of the day on which the notice is issued, but be inclusive of the day for which the notice is given. This period shall not, further, apply to supplementary agendas which may be issued as the exigencies of the case may require, subject to the proviso that only such urgent matters as cannot wait till the succeeding meeting of the Council shall be included in them.

69. The Secretary shall summon a special meeting of the Council on receipt of a requisition in writing signed by at least ten members of the Council, and within 30 days of the receipt of the requisition. The notice of such special meeting shall state the purpose for which the meeting is called, and its period shall be the same as in Bye-law 67.

70. At any meeting of the Council, each member of the Council present in person shall have one vote. Except as provided in Bye-laws 42 and 43 all questions shall be decided in the Council by a majority of those present and having a right to vote. In the case of equality, the President or other person presiding shall have a second or casting vote. A postal vote of the Council shall, however, be taken whenever:

(a) any six present in person at the meeting shall demand it; or,

(b) any twelve, whether present at the meeting or not, shall by notice in writing delivered to the Secretary before the hour fixed for the meeting, demand it; or,

(c) the meeting of the Council shall so direct;

71. The Council shall cause a statement of the funds of the Institution, and of the receipts and expenditure during the past year, terminating 31st August, to be made, and verified and signed by the Auditors. The Council shall cause such accounts to be presented at the Annual General Meeting.

the Council. The notice of such special meeting shall state the purpose for which the meeting is called. Twenty-one days' notice for such a meeting shall be given.

62. A meeting of the Council at which a quorum is present shall be competent to exercise all or any of the authorities, powers and discretions vested in or exercisable by the Council. Twenty members shall constitute a quorum for the Council. If at any meeting there is no quorum, the Council shall stand adjourned for twenty-four hours and shall meet at the same place and transact the business of the meeting. No quorum is required for such adjourned meeting.

63. Subject as hereinafter provided, questions arising at any meeting of the Council shall generally be decided by a majority of votes : the President shall have a second or casting vote, provided nevertheless that a postal vote shall be taken whenever :

(a) the meeting of the Council shall so direct;

(b) any six present at the meeting shall demand it;

(c) any twelve, whether present at the meeting or not, shall, by notice in writing delivered to the Secretary not less than seventy-two hours before the hour fixed for the meeting, demand it.

Executive Committee

64. The President, the Vice-Presidents, and three other members of the Council elected by the Council annually shall constitute the Executive Committee. The Executive Committee shall exercise its powers, functions and duties in accordance with the directions of the Council.

The powers of the Executive Committee shall be specified in the Regulations, and may be modified by the Council from time to time.

Powers of Division Councils

65. Until and unless the Regulations otherwise direct, a Division Council shall exercise the following powers, duties and functions :

(a) To direct the activities of the Division in attaining the objects of the Institution in that particular Division.

(b) To advise the Council in regard to matters in which the Division is interested.

66. Subject to the Regulations and other directions of the Council, each Division Council shall decide its own procedure regarding the meetings of the Division Council.

Funds, Investments and Accounts

79. The income and property of the Institution, whensoever derived, shall be applied solely to the promotion of the business and objects of the Institution as set forth in the Charter. No member of the Council shall be appointed to any salaried office of the Institution and no remuneration shall be given by the Institution to any Member of the

72. The Council shall draw up an Annual Report of the Council on the state of the Institution, and shall present it at the Annual General Meeting.

73. The Council may make, amend or rescind Regulations but so that the same be not repugnant to the Charter and the Bye-laws, and provided that no such addition, amendment or rescission shall come into operation until the same has been approved by a Special General Meeting of Corporate Members.

74. The Council may, upon receipt of a request to that effect from any Society with objects kindred to those of the Institution, arrange for the amalgamation of such Society with the Institution, and may also extend such concessions as they think fit to members of such Society at the time of amalgamation to facilitate their admission into the Institution. But no such amalgamation shall be effective until it is sanctioned by a Special General Meeting of Corporate Members.

FINANCES

75. The revenue of the Institution shall form the general funds of the Institution and all its property, income and effects, of whatsoever kind, are vested in the Corporate Members as such Corporate Members for the furtherance of the objects of the Institution as defined in the Charter.

Council except repayment of out-of-pocket expenses and interest on money lent or rent for premises demised to the Institution.

80. All compounding fees, received from Members, Associate Members, Companions and Subscribers, and all admission fees shall be regularly invested, as soon as possible after the receipt thereof by the Bankers, as instructed by the Executive Committee in any one or more of the securities appearing in the List of Securities appended to the Bye-Laws, and only the interest accruing therefrom shall be available for the general expenditure of the Institution. Such moneys and investments shall form the Permanent Reserve Fund. The Executive Committee shall be at liberty :

(a) To vary the investments at their discretion within the limits of approved securities ;

(b) To deposit all or any of the securities representing the Permanent Reserve Fund with the Bankers of the Institution to secure an overdraft on current account not exceeding Rs. 50,000 at any time; and

(c) To spend any portion of the Permanent Reserve Fund in purchasing land, buildings, furniture and equipment for the Institution and/or any Local Centre.

Save as aforesaid, no portion of the Permanent Reserve Fund shall be alienated without the consent of the Institution, to be obtained by a postal vote, on which vote the majority shall be not less than three-fourths of the effective votes received.

The Executive Committee shall have the power to make from time to time such additions as they consider desirable to the Permanent Reserve Fund from the General Funds of the Institution and the provisions of the Bye-Laws shall apply to these additions exactly as if they had formed part of the receipts required by the Bye-Laws to be invested for forming that Fund.

81. All the securities and moneys, the property of the Institution, shall be lodged with the Institution's Bankers in the name of the Institution. Any surplus funds not required for the current expenditure and not carried by the Executive Committee to the Permanent Reserve Fund shall be invested from time to time by the Bankers, as instructed by the Executive Committee, in any one or more of the securities appearing in the List of Securities appended to the Bye-Laws as a Temporary Reserve Fund and no securities forming part of this Fund shall be sold or otherwise disposed of except by order of the Executive Committee.

82. True accounts shall be kept of the sums of money received and expended by the Institution and the matters in respect of which such receipts and expenditure take place, and of the property, credits and liabilities of the Institution. The account of the receipts and expenditure shall be considered monthly by the Executive Committee of the Council, The accounts shall be audited not less often than once annually by the Auditor or Auditors of the Institution. The Audited Accounts of the preceding financial year shall by presented by the Council for consideration and passing with the Annual Report (of

76. Under no pretence whatever shall any such property, income, revenue or effects of the Institution, derived howsoever, be paid or transferred directly or indirectly by way of dividend or bonus or otherwise by way of profit to the members of the Institution except in the case of and as a salaried officer or employee of the Institution. Provided always that nothing herein contained shall prevent—

(a) the payment by the Institution in good faith of reasonable and proper remuneration to any member of the Institution for any services rendered to the Institution;

(b) the payment by the Institution of interest on money lent to the Institution by any such member or reasonable or proper rent for premises devised or let by any such member to the Institution; or

(c) the giving by Institution to any such member of prizes, whether in cash or otherwise, and scholarships for the furtherance of the objects of the Institution.

77. The Council shall constitute a Finance Committee from amongst their members, and the strength of the Finance Committee shall not exceed five. Every vacancy that arises shall be filled by the Council by election from amongst their members.

78 All compounding fees, received from Members and Associate Members and all admission fees shall be regularly invested, as soon as possible after the receipt thereof by the Bankers, as instructed by the Council in any one or more of the securities appearing in the List of Securities hereinafter referred to as approved Securities appended to the Bye-laws, and only the interest accruing therefrom shall be available for the general expenditure of the Institution. Such moneys and investments shall form the Permanent Reserve Fund. The Council shall be at liberty:

(a) To vary the investments at their discretion within the limits of approved securities;

(b) To deposit all or any of the securities representing the Permanent Reserve Fund with the Bankers of the Institution to secure an overdraft on current account not exceeding Rs. 50,000 at any time; and

(c) To spend any portion of the Permanent Reserve Fund in purchasing land, buildings, furniture and equipment for the Institution or any Local Centre or Sub-Centre.

Save as aforesaid, no portion of the Permanent Reserve Fund shall be alienated without the consent of the Corporate Members, to be obtained by a postal vote, on which vote the majority shall be not less than three-fourths of the effective votes received.

The Council shall have the power to make from time to time such additions as they consider desirable to the Permanent Reserve Fund from the general funds of the Institution and the provisions of the Bye-laws shall apply to these additions exactly as if they had formed part of the receipts required by the Bye-laws to be invested for forming that Fund.

which they shall form part) at each Annual General Meeting and they shall be printed in the form of:

(a) a Balance Sheet, and a Permanent Reserve Account;

(b) one or more Revenue and Expenditure Accounts; and

(c) separate accounts of endowments or trust funds created for specific purposes, in the appropriate publication of the Institution as soon as possible after the Annual General Meeting.

83. All donations to the Institution shall be enumerated in the Annual Report of the Council presented to the Annual General Meeting.

84. No payments from the moneys or funds of the Institution shall be made except by direction of the Executive Committee under the express or implied sanction of the Council, and all cheques shall be signed by the Secretary and one member of the Executive Committee.

General Meetings

67. General Meetings shall be held at such places and at such times as the Council shall decide but so that one of such meetings (referred to in these Bye-Laws as the 'Annual General Meeting') shall be held in the month of November or December or January in every year. Every General Meeting other than the Annual General Meeting shall be called an 'Ordinary General Meeting'.

68. General Meetings of the Institution shall be of the following categories:

(a) Annual General Meeting called for the business prescribed in the Bye-Laws.

(b) Ordinary General Meeting called by the Council for the business prescribed by resolutions of the Council.

(c) Ordinary General Professional Meetings held for discussion of matters of interest to the growth of the science and profession of engineering.

Annual General Meetings shall always be followed by Ordinary General Professional Meetings.

79. All the securities and moneys forming the assets of the Institution shall be lodged with the Institution's Bankers in the name of the Institution. Any surplus funds not required for the current expenditure and not carried by the Council to the Permanent Reserve Fund shall be invested from time to time by the Bankers, as instructed by the Council, in any one or more the securities appearing in the List of Securities appended to the Bye-laws as a Temporary Reserve Fund; and no securities forming part of this Fund shall be sold or otherwise disposed of except by order of the Council.

80. True accounts shall be kept of the sums of money received and expended by the Institution and the matters in respect of which such receipts and expenditure take place, and of the property, credits and liabilities of the Institution. The accounts of the receipts and expenditure shall be considered at regular intervals by the Finance Committee. The accounts shall be audited once annually by the Auditor or Auditors of the Institution. The Audited Accounts of the preceding financial year shall be presented by the Council for consideration and passing with the Annual Report of the Council at each Annual General Meeting and they shall comprise:

(a) a Balance Sheet, and

(b) separate accounts of endowments or trust funds created for specific purposes.

81. No payments from the moneys or funds of the Institution shall be made except under the express or implied sanction of the Council, and all cheques shall be signed by the Controller of Accounts and the Secretary.

82. The names of all persons who have made any voluntary contributions to the funds of the Institution shall be enumerated in the Annual Report of the Council presented to the Annual General Meeting.

GENERAL MEETINGS

83. The General Meetings of the Institution shall be of the following classes:

(a) The Annual General Meeting of Corporate Members only, for the business prescribed in the Charter and the Bye-laws;

(b) Special General Meeting of Corporate Members for the purpose of

 (i) considering making amendment or revocation of the Regulations made by the Council under the provisions of Bye-law 72;

 (ii) considering any resolution duly passed by the Council and requiring the confirmation of the Corporate Members;

 (iii) considering the specific matters to be moved at such Special General Meeting pursuant to any requisition signed by not less than one hundred Corporate Members and submitted to the Secretary.

(c) Extraordinary General Meeting of Corporate Members for the purpose of making, amending or rescinding any Bye-laws of the Institution.

Business at the Annual General Meeting mentioned in (a) and of the Ordinary General Meeting mentioned in (b) above shall be governed by Bye-Laws 69, 70, 71, 72 and 73. Ordinary General Professional Meetings may be held Divisionwise, and may be presided by a Corporate Member considered competent and interested in the subject matter of discussion. The Council shall frame rules for the holding of such Ordinary General Professional Meetings at the Local Centres and at other places all the year round.

69. Ordinary General Meetings shall be conducted as follows: The Chair having been taken, any communication prescribed by the Bye-Laws or deemed advisable by the Council shall then be made and discussed. Motions emanating from the Council shall then be announced and discussed and voted upon or adjourned for discussion at a subsequent meeting, after which motions of which not less than twenty days' notice in writing to the Secretary has been given (except by consent of the Chairman which shall not be given if a majority of the Corporate Members present shall, on being informed of the substance of the motion, vote by show of hands against the motion being put) and which are duly seconded shall be discussed and voted upon or adjourned for discussion at a subsequent meeting. Amendments to motions shall be in writing unless excused by the Chairman. Not more than a single amendment to the original motion shall be laid before the meeting at one time. When any such amendment has been negative, or has to be allowed to take the place of the original motion, other amendments involving a fresh point may be proposed. No one other than a Corporate Member shall speak on any motion or amendment except by invitation or permission of the Chairman, and no one shall speak more than once except by permission of the Chairman on any motion or amendment except the mover thereof, who shall be entitled to reply on the points raised in the discussion before a vote is taken on the motion or amendment.

70. At the Annual General Meeting, the Annual Report of the Institution together with the Audited Accounts for the preceding financial year shall be presented by the Council to be considered and, if approved, to be passed by the meeting. The names of the new President, Vice-Presidents/Chairmen of the Divisions, Chairmen of the Local Centres, and Members of the Council shall then be announced, and they shall thereupon be deemed the have entered into office, and the retiring President, Vice-Presidents/Chairmen of the Divisions, Chairmen of the Local Centres, and Members of the Council shall be deemed to have vacated office. The Chair shall then be vacated and filled again as hereinafter prescribed. The meeting shall then proceed with the current business of the Institution as hereinafter prescribed for an Ordinary General Meeting.

71. (1) An Extraordinary General Meeting, may at any time be called by the Council and shall be called by the Council on a requisition signed by not less than one hundred Corporate Members of whom not less than fifty shall be Members. The requisition shall state the objects of the meeting and must be signed by the requisitionists and deposited at the Office and may consist of several documents in like form signed by one or more requisitionists.

(2) At an Extraordinary General Meeting, only the special business of which notice has been given or such questions as necessarily arise thereon shall be considered,

84. The Annual General Meeting shall be held at such places as the Council shall determine but in the months of January or February in every year. But if not held due to unavoidable reasons, the Council shall have the power to hold the Annual General Meeting in any other month, and the reasons for the postponement shall be announced at the Annual General Meeting. Only Corporate Members shall be entitled to attend. The business of the Annual General Meeting shall be to receive the Audited Accounts of the Institution and the Annual Report of the Council for the preceding financial year and the report on the elections to the Council, and appoint Auditors and fix their remuneration.

85. Special General Meetings of Corporate Members shall be held at such places as the Council shall determine for the puposes stated in Bye-law 28(b). The requisition for the purpose of a Special General Meeting under Bye-law 82(b) (iii) shall be signed by at least one hundred Corporate Members and shall state the specific matters to be moved at such Special General Meeting and delivered to the Secretary. Upon receipt of such a requisition the Council shall be bound to call a Special General Meeting of Corporate Members, and shall cause the notice of the Special General Meeting to be issued within ninety days of the receipt of the requisition by the Secretary. At such Special General Meeting only the special matters of which notice has been given or such questions as necessarily arise thereof shall be considered.

86. An Extraordinary General Meeting of Corporate Members may be called at any time by the Council at such places as the Council may decide for the purpose of making, amending or rescinding any Bye-laws of the Institution. The Council shall be bound to call an Extraordinary General Meeting whenever a requisition signed by at least one hundred Corporate Members is made and delivered to the Secretary, specifying the additions, amendments or rescissions to the Bye-laws suggested by them, and shall cause the notice of the Extraordinary General Meeting to be issued within ninety days of the receipt of the requisition by the Secretary.

87. No new Bye-law, or rescission of any existing Bye-law, shall be proposed at any General Meeting of the Institution, except an Extraordinary General Meeting convened in accordance with the provisions of Bye-law 85.

88. Notice of the making, amending or rescinding of any Bye-law shall be published in the appropriate publication of the Institution as soon as it is reasonably practicable after the same shall have been passed in accordance with the provisions of the Charter and the Bye-laws.

89. At least twenty-five days notice shall be given of all General Meetings of Corporate Members. This period of twenty-five days shall be exclusive of the day on which the notice is deemed to be given but be inclusive of the day for which the notice is given. In the case of an Extraordinary General Meeting being convened for the purposes of of Bye-law 85, the instrument for appointing a proxy as described in Bye-law 95 shall accompany the notice.

90. Service of a notice shall be deemed to be effected by properly addressing, prepaying and posting the letter containing the notice. The accidental omission to give

and no one other than Honorary Life Members, Members and Associate Members shall be permitted to be present thereat, and to them only shall notice of the meeting be sent.

72. The proceedings at all General Meetings shall be regulated as follows :

(a) The President, if present, shall take the Chair, and in his absence one of the Vice-Presidents, or in their absence the senior Member of Council present, If neither the President, a Vice-President nor any Member of the Council be present on the expiry of fifteen minutes after the hour fixed for the meeting, the Corporate Members present shall proceed to elect a Chairman from their number.

(b) Fifty Corporate Members shall constitute a quorum. In the event of a quorum not being present within thirty minutes of the hour fixed for the commencement of the meeting, the meeting shall stand adjourned to the same hour and place on the following day when the members present whatever their number shall constitute a quorum.

(c) Twenty-one days' notice at the least (exclusive of the day on which the notice is deemed to be served, but inclusive of the day for which notice is given) specifying the place, the day and the hour of any General Meeting, and in case of the Annual General Meeting a copy of the Audited Accounts shall accompany the notice, and in case of special business, shall be given, except as hereinafter provided to all Membrs and Attached Persons by post to their registered addresses in India; but the non-receipt of the notice by any person entitled by this Bye-Law to receive it shall not invalidate the proceedings of any General Meeting.

73. At all General Meetings, every Corporate Member shall have on vote and, save as otherwise hereinafter expressly provided, votes shall ordinarily be taken from those only personally present at the meeting and by show of hands but a poll may be demanded by any person entitled to vote. The Chairman shall be entitled to a vote and when votes are equal, he shall have an additional or casting vote.

74. Votes by means of voting papers sent through posts shall be taken (a) in the case of postal vote of the Council from the President, Vice-Presidents/Chairmen of the Divisions, Chairmen of the Local Centres, and Members of the Council; (b) in the case of a postal vote of the Institution from all Corporate Members. A postal vote of the Institution shall be taken :

(a) when expressly prescribed to be so taken by the Bye-Laws ;

(b) when, in its opinion, the Council considers it in the interest of the Institution that an appeal should be made from a decision of an Ordinary General Meeting to the whole body of the Institution; and

(c) when otherwise, in its discretion, the Council thinks fit or necessary.

In all cases, the subject matter to be voted on with such explanation as may be necessary shall be circulated to every member entitled to vote. This circular shall specify the place and date of return, and shall be issued not less than thirty days prior to that date of return. Any votes received after that date shall not be considered.

notice of a General Meeting of Corporate Members to, or the non-receipt of notice of such a meeting by, any Corporate Member entitled to receive notice shall not invalidate the proceedings of that meeting.

PROCEEDINGS OF GENERAL MEETINGS

91. No business shall be transacted at any General Meeting of Corporate Members unless a quorum is present when the meeting proceeds to business. The Corporate Members present shall be the quorum for the Annual General Meeting, fifty Corporate Members for a Special General Meeting, and one hundred Corporate Members for an Extraordinary General Meeting. If within thirty minutes after the time appointed for a Special General Meeting or an Extraordinary General Meeting, the requisite quorum is not present, the meeting shall be dissolved.

92. The President, when present, shall be chairman at all General Meetings, and in his absence the chair shall be taken by a member of the Council in order of their seniority. But if no member of the Council is present and willing to act, the meeting shall elect a chairman from the Corporate Members present at the meeting.

93. The Chairman may, with the consent of the meeting, and shall if so directed by the meeting, adjourn the meeting by twenty-four hours. The adjourned meeting shall be held at the same place, but no quorum shall be necessary and no business shall be transacted at any adjourned meeting other than the business left unfinished at the meeting from which adjournment took place. It shall not be necessary to give any notice of an adjournment or of the business to be transacted at an adjourned meeting.

94. At all General Meetings of Corporate Members questions shall be decided according to the majority of votes properly given thereat by show of hands.

(i) unless a poll is, before or on the declaration of the result of the show of hands, demanded by at least ten Corporate Members present, provided no poll shall be demanded on the election of a chairman or on a question of adjournment;

In the case of an equality of votes the Chairman of the meeting shall both on a show of hands and at a poll, have a second or casting vote. The acceptance or rejection of votes by the Chairman shall be conclusive for the purpose of the decision of the matter in respect of which the votes are tendered;

(ii) unless instruments of proxy have been deposited with the Secretary in accordance with the provisions of Bye-law 97, in which case due account shall be taken of them.

95. Votes may be given at any General Meeting of Corporate Members either personally or by proxy. Each Corporat Member present in person or by proxy shall have one vote. No person shall be appointed a proxy to vote at any meeting who is not a Corporate Member entitled in his own right to vote at such meeting.

75. No person appointed to any office in the Institution to which a salary is attached shall have the privilege of voting at a General Meeting of the Institution. If a Corporate Member be appointed to any such office, he shall be incapable of voting for so long as he continues to hold it but shall not be deprived of any of his privileges.

Additions and Alterations of Bye-Laws

77. (1) Meeting of the Corporate Members of the Institution for the purposes of considering any question as to the making, revocation; alteration or amendment of any Bye-Law or Bye-Laws in pursuance of the provisions of Clause 17 of the Charter shall be called by the Council whenever the Council decide to call such a meeting and whenever they are required so to do by a requisition signed by not less than one hundred Coporate Members of whom not less than fifty shall be Members. The requisition shall state the matters required to be taken into consideration at the meeting and must be signed by the requisitionists and deposited at the Office, and may consist of several documents in like form signed by one or more requisitionists.

(2) The meeting shall be held at such place as the Council may decide, and two weeks' notice at the least (exclusive of the day on which the notice is deemed to be served, but inclusive of the day for which notice is given) specifying the place, day and hour of the meeting and the matters to be taken into consideration thereat shall be given to all the Corporate Members of the Institution by post to their registered address in India.

(3) The meeting shall be held in accordance with the rules for General Meetings as prescribed in Bye-Law 72.

78. Notce of the making, revocation, alteration or amendment of any of the Bye-Laws shall be published in the appropriate publication of the Institution as soon as is reasonably practicable, and the same shall be deemed to be duly served on Honorary Life Members, Members, Associate Members, Companions, Graduates, Students, Subscribers and Technicians, and such service shall be deemed to be effected, unless a later date is specifically stated in the notice, on the date of issue of the publication in which the notice appears.

Register of Members and Attached Persons

76. Every Honorary Life Member, Member, Associate Member, Companion, Graduate, Student, Subscriber and Technician shall register with the Secretary an address in India to which all notices and communication may be sent to him, and if he shall register no address in India, he shall not be entitled to any notice, and such registered address may from time to time be changed by him on notice to the Secretary,

96. The instrument appointing a proxy shall be in writing under the hand of the appointer and shall as nearly as circumstances will admit be in the form or to the effect following :—

The Institution of Engineers (India)

I or

being a Corporate Member of the above Institution hereby appoint

of

or failing him of

as my proxy at the (Annual General Meeting, Special General Meeting or Extraordinary General Meeting as the case may be) of The Institution to be held on the day of 19 and at any poll held in connection therewith.

As witness my hand day of 19 .

Signature..

Class of membership in I.E.I.................................

97. The instrument appointing a proxy shall be deposited with the Secretary not less than seven days before the hour fixed for the meeting at which the person named in the proxy proposes to vote, but no instrument appointing a proxy shall be valid after expiration of three calendar months from its date.

98. A poll shall be taken by means of postal voting papers and shall be a poll of all Corporate Members who at the time of despatch of such papers shall be entitled to receive notice of a meeting,

(a) when expressly specified to be so taken in the Bye-laws;

(b) when Corporate Members demand it under the provisions of Bye-law 93 (i);

(c) when, in its opinion, the Council considers it in the interests of the Institution that an appeal should be made on any question to the whole body of Corporate Members.

The form and contents of the voting papers shall specify the subject matter to be voted upon and the date of return thereof, and shall be issued at least thirty days, exclusive of the day on which the papers are deemed to be issued but inclusive of the day of return, prior to the date of return.

and all notices addressed to any Member, Associate Member, Companion, Graduate, Student, Subscriber or Technician posted to his registered address in India for the time being, shall be deemed to be effectively served and made, notwithstanding that through absence or otherwise the addressee may not in fact have received the notice or communication. Where a notice is sent by post, service of the notice shall be deemed to be effected by properly addressing, prepaying and posting a letter containing the notice and to have been effected at the time at which the letter would be delivered in the ordinary course of post.

Adminstration of Local Centres

85. The constitution of the Committees of the Local Centres shall be prescribed in the Regulations by the Council.

The Council shall have overriding powers in all matters concerning the administration and working of the Local Centres.

Regulations

86. The Council shall have the power to frame Regulations if and when necessary for the proper execution of the Charter and the Bye-Laws. As to the interpretation of the Charter and the Bye-Laws, the decision of the Council shall be final. The Council shall also have power to revise or modify the Regulations subject to confirmation at the Annual General Meeting.

NOTICES

99. A notice may be served by the Council or the Secretary upon any member of any class either personally or by sending it, whether as a separate communication or included in or with one of the publications of the Institution, prepaid through the post addressed to such person at his recorded address.

100. Any notice served or sent by post shall be deemed to have been served or delivered at the expiration of ninety-six hours after it was posted.

101. A member whose recorded address is not in India shall not be entitled to any notice, and all proceedings may be had and taken without notice to such a member in the same manner as if he had received one notice.

COPYRIGHT

102. Each paper presented to the Institution and accepted for reading or publication in full or in abstract shall be the property of the Institution. The Council, in such cases as they may think fit, shall have power to release or surrender the rights of the Institution in respect of any such paper or the copyright thereof.

INDEMNITY

103. Each member of the Council and the Secretary shall be indemnified out of the funds of the Institution and to such extent as the Council shall approve from and

APPENDIX TO THE BYE-LAWS

List of Securities

Referred to in Bye-Law 80 (Permanent Reserve Fund) and Bye-Law 81 (Temporary Reserve Fund)

1. Debentures, stock or securities of the Central Government or of any State Government.

2. Debentures, stock or securities of a corporate body, both the principal whereof and the interest whereon shall have been fully and unconditionally guaranteed by the Central Government or State Government(s).

3. Debentures or other securities for money issued, under the authority of any Central Act or Act of a State Legislature, by or on behalf of any municipal body, Port Trust, City Improvement Trust or autonomous corporation.

against such costs, charges, damages and expenses as he may sustain by reason of his acting in execution of the duties or powers imposed upon or given to him by the Charter or the Bye-laws.

104. Each member of the Council and the Secretary shall not be accountable and shall not incur any personal liability in respect of any loss or damage incurred through any act, matter or thing done, authorised or suffered, being done in good faith for the benefit of the Institution, although in excess of his legal power or incurred through any omission, error of judgment, or oversight on his part.

COMMON SEAL

105. The Council shall provide a Common Seal of the Institution. The Seal shall be in the custody of the Secretary and be affixed to such documents as in law are required to be sealed, but only in the presence of the Secretary or such other person or persons the Council may appoint for the purpose. The Secretary or such other person or persons shall sign every instrument to which the Seal of the Institution is so affixed in his presence.

INSTITUTION BADGE

106. The Council shall approve the design of a badge to be worn by all Corporate and Non-Corporate Members.

APPENDIX TO THE BYE-LAWS

List of Securities

Referred to in Bye-law 78 (Permanent Reserve Fund) and Bye-law 79 (Temporary Reserve Fund)

1. Debentures, stock or securities of the Central Government or of any State Government.

2. Debentures, stock or securities of a corporate body, both the principal whereof and the interest whereon shall have been fully and unconditionally guaranteed by the Central Government or State Government(s).

3. Debentures or other securities for money issued, under the authority of any Central Act or Act of a State Legislature, by or on behalf of any municipal body, Port Trust, City Improvement Trust or autonomous corporation.

FORM OF PROXY

The Institution of Engineers (India)

I,..................................of..........................in the district of.............................being a Corporate Member of the above-named Institution hereby appoint.......................of:.........................in the district of....................or failing him..............................of ....in the district of........................as my proxy to vote for me on my behalf at the meeting under Bye-law 77 of the Corporate Members of the Institution to which I belong to be held on Saturday, the 19th October, 1963, and at any adjournment thereof.

Signed this................day of................1963.

20nP

Revenue stamp

Signature..................................

Name.....................................

Membership No...........................

HEAVY ENGINEERING COMPLEX AT RANCHI

S. C. Bannerjee
Non-member
Public Relations Officer, Heavy Engineering Corporation, Ranchi

The Heavy Engineering Corporation, a fully-owned Government of India undertaking, was incorporated on December 31, 1958, with its headquarters at Ranchi, for developing the manufacture of heavy capital equipment in India. India has now to depend on imports for such equipment, involving a considerable amount of foreign exchange every year. The need for such equipment has been on the increase and is going up still more. The Heavy Engineering Corporation is at present setting up the following four projects :

1. Heavy machine building plant }
2. Foundry forge plant } in Ranchi
3. Heavy machine tool plant }
4. Coal mining machinery plant in Durgapur

Recently, the Corporation has also been entrusted with the responsibility of setting up additional capacity for coal mining machinery items through one or more new plants, as well as for developing coal handling and/or beneficiation plants including washeries in technical collaboration with the Government of Poland.. These projects when in production will contribute to a great extent in laying the foundation for heavy engineering industries and will be proud landmarks in India's progress towards industrial self-sufficiency. As a single heavy engineering complex, the Corporation may be considered as one of the biggest enterprises of its kind in the world by any standard.

Heavy machine building plant

The heavy machine building plant is being set up at Ranchi in collaboration with the U.S.S.R. and has been designed to produce diverse types of heavy machinery items. The project is being implemented for a production capacity of 80,000 tons of machinery items every year in two stages, with a first stage of 45,000 tons. Both the stages are being developed concurrently. Adequate provison has also been made for further expansion of the capacity to 165,000 tons of finished machinery items or to any other intermediary stage as may be necessary. The plant is intended to produce primarily machinery and equipment for the iron and steel industry. It will also possess adequate facilities and capacity to meet the requirements of machinery and equipment for other major industries like mineral oil (oil drilling rigs), coal mining, chemical, fertilizer, cement, etc., as well as for the manufacture of general engineering items like heavy cranes, excavators, crushing and grinding equipment. The plant is expected to go into pilot production by the end of 1963 and will have on its roll over 4,500 workers and staff at the 80,000-ton stage.

Production programme

An approximate break-up of the items proposed to be manufactured in this plant is given below.

Description of item	Figures in tons	
	First stage (45,000)	Second stage (80,000)
Coke ovens and by-product equipment	6,600	7,700
Blast furnace equipment	4,000	5,500
Steel making equipment	5,000	7,000
Crushing and grinding equipment	2,100	3,150
Crane equipment	4,400	6,570
Rolling mill equipment	20,000	34,500
Spare parts for metallurgical equipment	1,500	1,080
Heavy mining equipment	—	880
Excavators	—	4,950
Press forging equipment	—	1,360
Heavy oil drilling rigs	—	5,500
Miscellaneous heavy machine parts and assemblies	2,000	1,810
Total	45,000	80,000

Technical knowhow

Most modern tools machinery and the latest technical knowhow and design facilities will be employed for production in this plant. There will be wide flexibility for the manufacture of diverse types of machinery for any heavy industry, based not only on standard designs and specifications of proved performances elsewhere but also to customer's own designs. To enable the customers have the benefit of the latest design facilities, a fully equipped Design Bureau with more than 600 design engineers trained in most advanced plants and industries is being established. The Bureau will be capable of undertaking various designs for any heavy industry.

Production shops

One of the most modern of its kind in the world, the plant covers an area of 57,00,00 m^2. It will consist of five main production shops:

(i) Heavy machine department;

Fig. 1

A 100-ton crane being erected in the Heavy Machine Building Plant

(ii) Medium and small machine department;

(iii) Block of department for coke oven by-products and handling equipment;

(iv) Reduction gear department; and

(v) A large number of other auxiliary and service units.

A total of 738 items of machine tools and 116 items of overhead cranes, jibs and other handling equipment, amounting to about 25,000 tons will be erected in this plant. This includes 97 electric overhead travelling cranes ranging in capacity from 3 tons to 150 tons. The bed of the largest lathe in this plant will measure 20 m. (66 ft.) and the table dimensions of the largest planning machine will be 12 m. × 4 m. (approximately 40 ft. × 13 ft.)

A fully equipped construction workshop has been set up to cater for the requirements of the construction works of all the three projects in Ranchi and also to produce non-standard equipment and industrial furnishings for the plants.

Foundry forge plant

The foundry forge plant is also being set up at Ranchi in collaboration with Czechoslovakia near the heavy machine building plant. In this plant, castings and forgings of practically any type and composition, from a few pounds to as heavy as 100-ton piece weights, will be produced. Such will be the scope of this project in the field of castings and forging that one feels tempted to venture and say, 'you name it and we make it' be it an item of steel industry or equipment for mining, heavy earthmoving, machine tool, power generation, or, for that matter anything that the country is likely to need in the near future.

One of the biggest

Equipped with the latest casting and forging techniques, the plant will be one of the biggest and most modern of its kind in the East. The fenced area of the plant exceeds 13,00,000 m.^{2}—the factory site is about one and one-half miles in length and three-fourths mile in breadth. The individual production units of the plant will be almost as big as many of the large factories in the country. For example, the length of the steel foundry is about 286 m. (310 yards), nearly three times the length of a foot-ball field. In all, about 40,000 tons of machinery will be installed in the plant. Some of the buildings will be about 130 ft. high with chimneys going up to 240 ft. and will have adequate inside clearance to accommodate 10-storeyed buildings without touching any of the structures. Some of these buildings will carry huge cranes of 200 tons and the big steel columns will weigh 140 tons with a steel base of about 300 sq. ft. A special feature of this plant is the underground soaking furnaces, the big ones measuring about 67 ft. long × 47 ft. wide × 84 ft. deep. Another very significant feature of the project is that, for the first time in India, all the detailed design and drawings required for a project of this complexity and size are being developed in India by Indian engineers under the technical guidance of Czech experts.

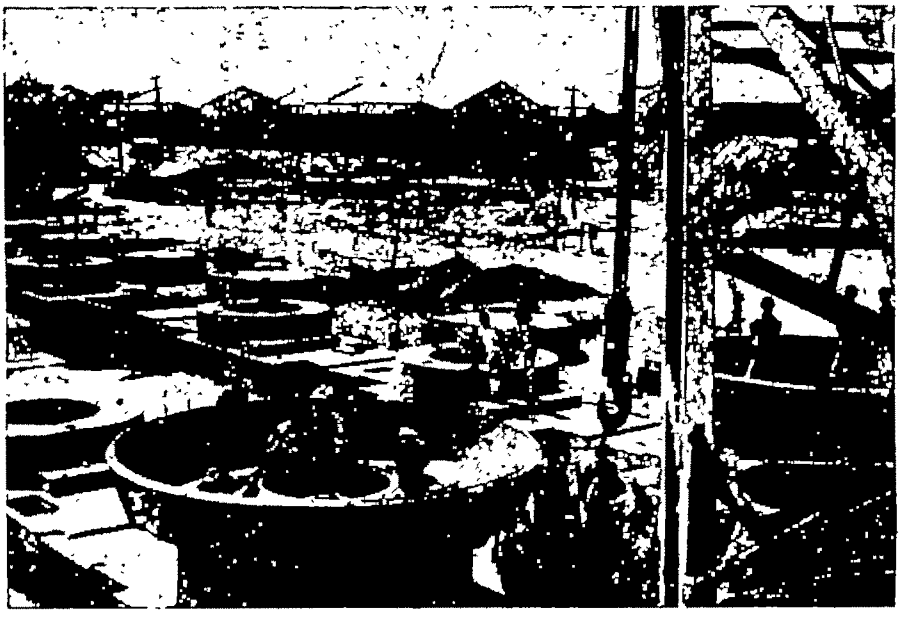

Fig. 2

Erection of gas producers at the Foundry Forge Plant

Production programme

The plant, as it is now being implemented, is expected to have the following production capacity per year.

Description	Capacity in tons
Grey iron foundry	46,600
Steel foundry	88,382
Non-ferrous foundry	700
Forge shop	32,954
Rough machine shop	64,015
Machine and heat treatment	21,310

In terms of size, specification and quantum, some of the castings and forgings of this plant will be produced for the first time in India, the maximum piece weight being 100 tons in the case of iron castings, 90 tons in the case of steel castings and 50 tons in the case of forgings. The plant will be equipped with a modern roll shop for the manufacture of 13,000 tons of grey iron, steel and forged rolls per year for meeting the requirements of the iron and steel industry. The manufacturing programme includes iron rolls of both alloyed and unalloyed varieties in semi-chilled, chilled and S. G. class, besides steel forged rolls. The manufacture of these is now confined only to a few countries in the world, and so far India's requirements of these rolls had to be imported. The demand for these rolls has been increasing and the foundry forge plant will have a vital role to play in this field, as it will be fully equipped to meet the country's demand for these items fully heat treated. Special and heavy duty shafts for turbine generating sets can also be supplied in machined and heat treated condition.

The heat treatment facilities will consist of annealing, normalizing and quenching, wherever required. Shafts up to 18 m. in length can be suitably heat treated in special furnaces provided for this purpose.

The production of this plant will be used primarly to meet the requirements of castings and forgings for heavy machine building and heavy machine tool plant. Provision has also been made for some surplus capacity to meet the demands for heavy castings and forgings from various other industries in the private and public sectors.

Production shops

The project will have four major production units, *viz*.,

(i) A steel foundry ;

(ii) A grey iron and non-ferrous foundry ;

(iii) A forge shop ; and

(iv) Rough machine and roll shops.

In addition, the plant will have its own well equipped pattern shop and fettling shop, a battery of gas producers and actylene and oxygen plants, besides power and gas services. The plant will also be equipped with a 6,000-ton press which will be the biggest so far in India.

The foundry forge project will help opening of new spheres of industrial and technological development in India which have so far been the privilege of only a few industrially advanced countries in the world. In full production, about 8,000 workers and staff will be employed in this plant which is expected to go into production by 1963.

Coal mining machinery project

The coal mining machinery plant is being set up at Durgapur, West Bengal, in collaboration with the U.S.S.R. The plant was intially designed to produce 30,000 tons of different types of coal mining machinery, but in view of the increase in the target of coal, it was decided in 1961 to expand the capacity of the plant immediately to 45,000 tons of machinery per year. The plant will occupy an area of 86 acres, 400 m. in breadth and 1,200 m. in length, along the Grand Trunk Road and will have fifteen main production and auxiliary shops and five storage buildings. The unit will be self-sufficient in respect of its castings and forgings, except for the heavier pieces which will be obtained from the foundry forge plant at Ranchi. On the other hand, it will have a spare capacity to supply to other industries about 2,800 tons of castings and forgings per year.

Production programme

The main units of the plant are as below.

(i)	A grey iron foundry	.. 11,000 tons
(ii)	A steel foundry	.. 9,000 tons
(iii)	A forge shop	.. 10,000 tons

(iv) A structural shop and two machine and assembly shops.

There will be other ancillary shops, *viz.*, melting and heat treatment shops, a skull cracker and scrap production yard, an oxygen plant, a boiler house for machining, fabricating and assembling operations, and these will contain about 862 machine tools and accessories. The factory has been designed to be almost fully mechanized and will be using approximately the following mechanical handling equipment:

(a)	Overhead travelling cranes	.. 84 nos.
(b)	Conveyors and elevators	.. 262 nos.
(c)	Jib cranes	.. 80 nos.
(d)	Industrial trucks and automobile fleet	.. 200 nos.

The plant will produce its own oxygen and compressed air.

Fig. 3

A workshop nearing completion at the Coal-Mining Machinery Plant

Production programme

When on full production, the plant is planned to produce the following items of coal mining machinery every year.

Description	Quantity	Weight in tons
Coal cutters	600 pieces	1,704
Loaders	250 pieces	1,371
Conveyors	1,800 pieces	22,487
Trolley and battery type electric mine locomotives	150 pieces	1,300
Haulages	400 pieces	3,804
Main axial fans	100 pieces	1,154
Electric winders	25 pieces	1,167
Booster fans	250 pieces	50
Centrifugal pumps	500 pieces	998
Sand pumps	300 pieces	550
Automatic cage keps for use in vertical shafts and safety detaching hooks, clips, etc.	—	—
Light drill rigs for exploration drilling	25 pieces	28
Spare parts	—	8,323

This is the first time that such a comprehensive and integrated plant is being set up in the country to manufacture so wide a range of diverse types of coal mining machinery. The plant is expected to provide employment to about 5,000 staff and workers at full production. The plant is expected to go into partial production by the end of 1963.

Heavy machine tool plant

In November 1960, the Government of India entrusted the Corporation with the responsibility of setting up a heavy machine tools plant at Ranchi near the heavy machine building plant, in colloboration with Czechoslovakia. This plant, as it is to be implemented, will have an annual production capacity of 10,000 tons of diverse items of heavy machine tools. Machine tools of large sizes and capacities will be produced for the first time in India. Adequate provision has been made for increasing the capacity of the plant to 20,000 tons per year or to any other intermediary stage, if considered necessary. When in full production, the plant is expected to manufacture approximately 278 complete machine tools. The average weight of each machine will be 25/30 tons, while the maximum weight of an individual machine is expected to be approximately 50 tons. The production range includes seven different groups of machine tools with 22 different capacity models.

Production programme

An approximate break-up of the proposed production programme of the plant is given below.

Description	Range of sizes to be produced	Peak production per annum	
		Nos.	Weight in tons
Central lathes	Swing : 1,000 to 3,159 mm.	70	3,455
Radical drilling machines	Spindle diameter: 80 to 100 mm.	36	412
Double column planning machines	Table width: 1,000 to 2,000 mm.	38	1,410
Horizontal borers	Spindle diameter: 100 to 160 mm.	53	1,069
Vertical boring and turning mills	Table diameter: 1,250 to 4,000 mm.	31	1,029
Planomilling machines	Table width: 1,250 to 1,600 mm.	20	1,000
Precision cylindrical and roll grinding machines	Swing: 400 to 800 mm.	30	429
Spares and accessories	—	—	1,186
		278	10,000

The plant is expected to go into trial production by 1966. At full production, it will provide employment to more than 2,000 staff and workers. A site measuring 130 acres to the north of the heavy machine building plant has been selected for this unit.

Training programme

To make available technical personnel, skilled and semi-skilled workers in adequate numbers to run these complex projects, a comprehensive training programme has been worked out. A Training Centre has been established which will be able to impart training to approximately 1,300 engineers and trade apprentices every year. Training is also being arranged in the various industrial undertakings in the country. Arrangements have been made for the advanced and specialized training of nearly 650 Indian engineers and technicians in Russia and Czechoslovakia.

Township

To provide residential accommodation to its employees, the Corporation is building two modern townships, one each at Ranchi and Durgapur. The township at Ranchi will spread over an area of about 5,600 acres, and it is estimated that ultimately about 25,000 quarters will have to be constructed in stages. The master plan for the township has been approved and construction of houses has already been taken up. The township at Durgapur will spread over an area of 1,500 acres. Provision has been made for construction of 5,000 quarters in stages. Pending construction of the permanent quarters, a temporary colony has been built near the factory site, to ease the problem of residential accommodation for the staff. Similarly, 350 temporary houses will be built at Durgapur. Expert's hostels have also been constructed in Ranchi and Durgapur to accommodate mainly the Russian and Czechoslovakian experts who will be in India in connection with the construction, erection and operation of the above plants.

Contemporary World Engineering Projects Series—25

Members are invited to contribute to this Series special articles featuring major engineering projects which they may have been associated in any other manner. Articles should be preferably accompanied by photographs and illustrative sketches.

MARINA CITY PROJECT—DESIGN AND CONSTRUCTION OF FOUNDATION*

Chicago's world famous, 67-storey Marina City appartment towers are the tallest apartment buildings in the world. The first two floors of these twin-apartment building towers are a part of the greater plaza area, the next 20 floors are spiral ramp parking facilities for 900 cars, then the next 40 floors provide for 896 apartments, and the top five floors include utilities, elevators, etc. The west tower supports a television broadcasting antenna and has an elevation of 917 ft. The plaza area includes marina facilities, skating rinks, bowling alleys, swimming pools and a 1,800-seat theatre.

The site

The location of the project is Chicago, Illinois, and has for its boundaries the Chicago River, the North Dearborn Street, the North State Street, and the West Kinzie Street. This Greater Chicago area is affected by the Pleistocene ice age. Early ice advances removed all the soils and almost all the soft shale overlying the hard Niagaran dolomitic limestone. The shale and its overburden were ground up and incorporated in the ice. The last Wisconsin ice sheet was probably around 10,000 ft. thick and weighed approximately 300 tons per sq. ft. The glaciers routed out blocks of limestone and striated the bed-rock. When atmospheric conditions changed, and the warmth of the earth melted the bottom of the glacier, the glacier retreated and glacial till was deposited from the bottom of the glacier. Large boulders of Niagaran limestone (also a few granitic boulders from the pre-Cambrian shield) gravels and sands were the first materials deposited, followed by dense silts, and then hard silty clays. This latter formation is locally called 'hard-pan.' The deposits were compressed under the heavy glacial loads, and are therefore very compact. These deposits on the top of the rock are glacial tills. Subsequent ice sheets of lesser thicknesses deposited more till—still hard, but not as hard as the hard-pan. At the end of the ice age, many lakes were formed in front of the ice, and water deposits were laid down by debris coming from the ends of the melting ice sheets. These deposits are soft silts and clays. However, some of the softer clays show no signs of stratification and are believed to have been deposited directly from the ice. Along the beaches and banks of the rivers, sands have been deposited. These sands have been transported by water current. Most recently, man-made fills have accumulated. In and around the Chicago Loop, debris from the Chicago fire of 1870 is prevalent.

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*Compiled from literature obtained by courtesy of Caso Foundation Co., U.S.A., who were the general foundation contractors of the project.

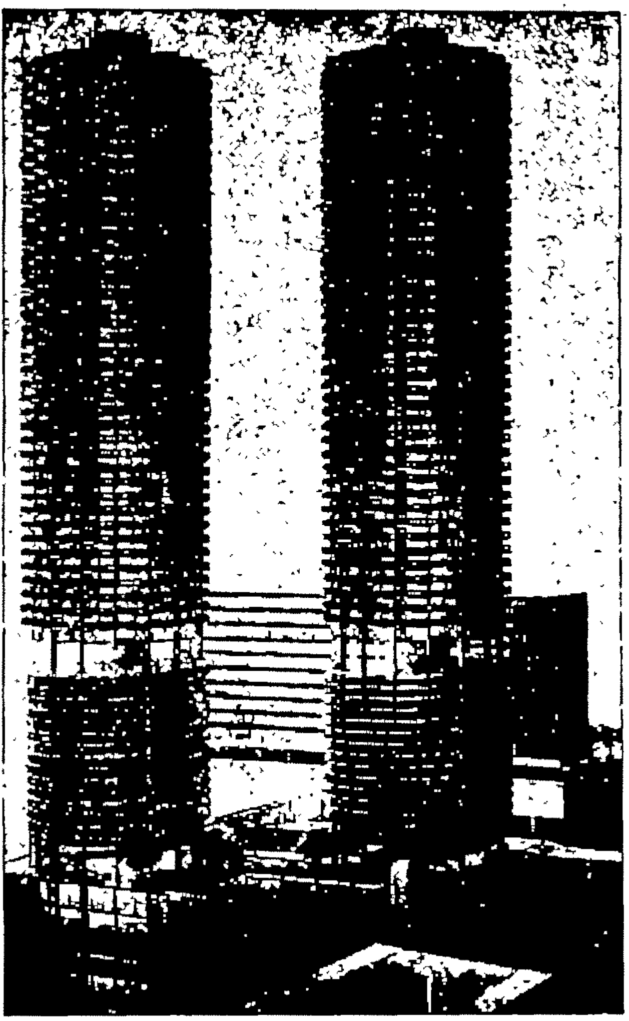


Fig. 1

The twin towers of Marina City

Tailoring of the foundation

The soil conditions were not favourable for spread footings because of the heavy loads and soft compressible silty clays, etc. Pile driving would have been most difficult, because the fill offers many obstructions and the boulder till prevents a pile from reaching the bed rock. High capacity piles would have had to be used because of the heavy loads. During construction of the abutment for the bascule bridge on the north side of the Chicago River at Dearborn Street, there appeared to have been ground settlement, and settlement was to be anticipated in the future. Should high bearing piles to rock hang up on boulders and should there be future loss of ground, the piles could be expected to settle. Drilled rock caissons offered a positive penetration into the rock

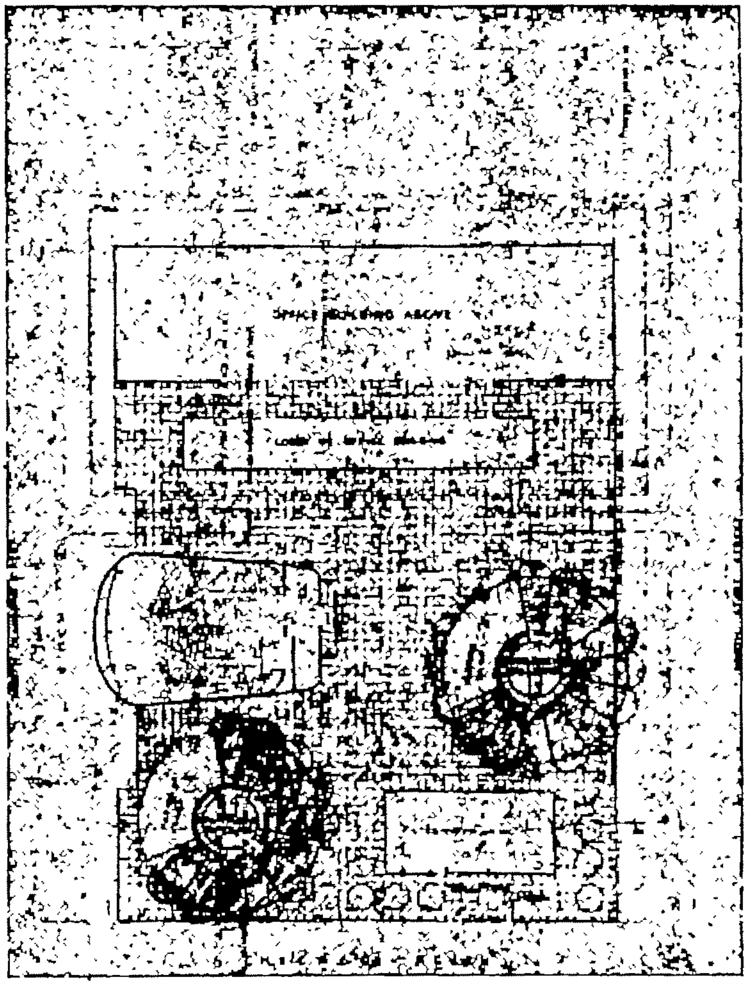


Fig. 2

Architectural plan view of Marina City

which could be checked by lowering an inspector in the caisson for visual inspection and physical testing. Preliminary estimates and contractual lumpsum prices also proved to be economical.

In the use of caissons, two water levels with abundance of water had to be considered and a means of shutting off the source applied. The man-made fill which contained miscellaneous cinders, brickbats, concrete footings, etc., as well as railroad cars, piling, old marine structures and an abandoned 60 ft. deep freight tunnel had to be taken into consideration. Boulder till protecting bed rock had to be penetrated. Generally, heavy duty pavement breakers are used to go through these boulders when they are in the dry. At this site, it was known that there was artesian water in the till above bed rock which would rise to lake level. Normally, industrial pumping

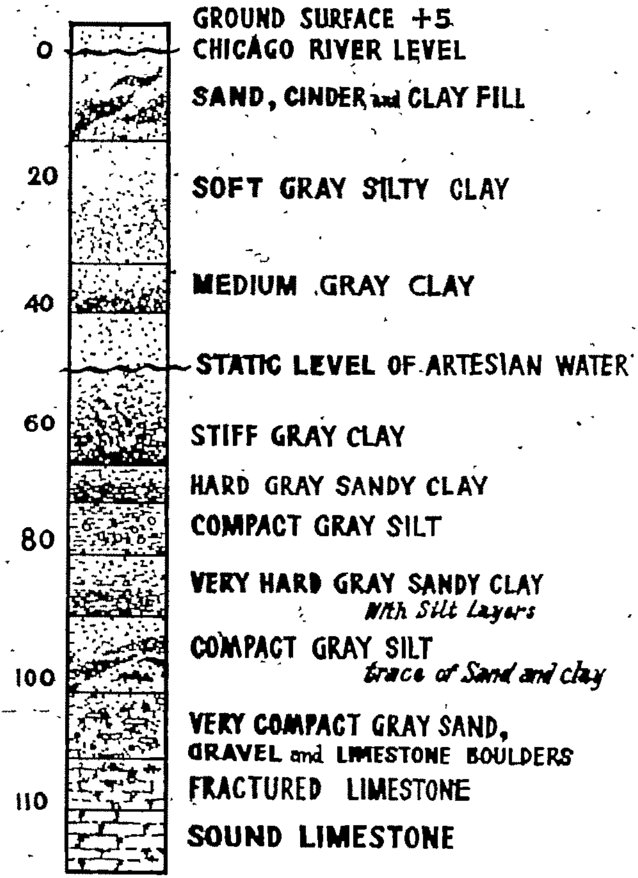


Fig. 3

Typical soil conditions of the site

and general construction in structures such as caissons, tunnels and shafts reduce the head of the artesian water. Loss of ground could not be tolerated due to the close proximity of the Dearborn and State Street viaducts, multistory buildings, and bascule bridges.

At early design stages of the project, it was evident that due to the heavy concentrated loads of the tower structures, caissons to rock would be the most economical and practical solution in tailoring the foundation. The case method was used.

The State Street and the Dearborn Street are viaduct structures supported on hardpan caissons. The Dearborn Street coffer dam was under construction at the start of and during the progress of the Marina project. Hand-dug rock caissons were being installed to support the bascule bridge support and seemed to have caused settlement of portions of the Marina area. Near Marina, the caissons were heavily reinforced to withstand lateral pressures of the earth adjacent to the coffer dam, as were the first two rows of caissons.

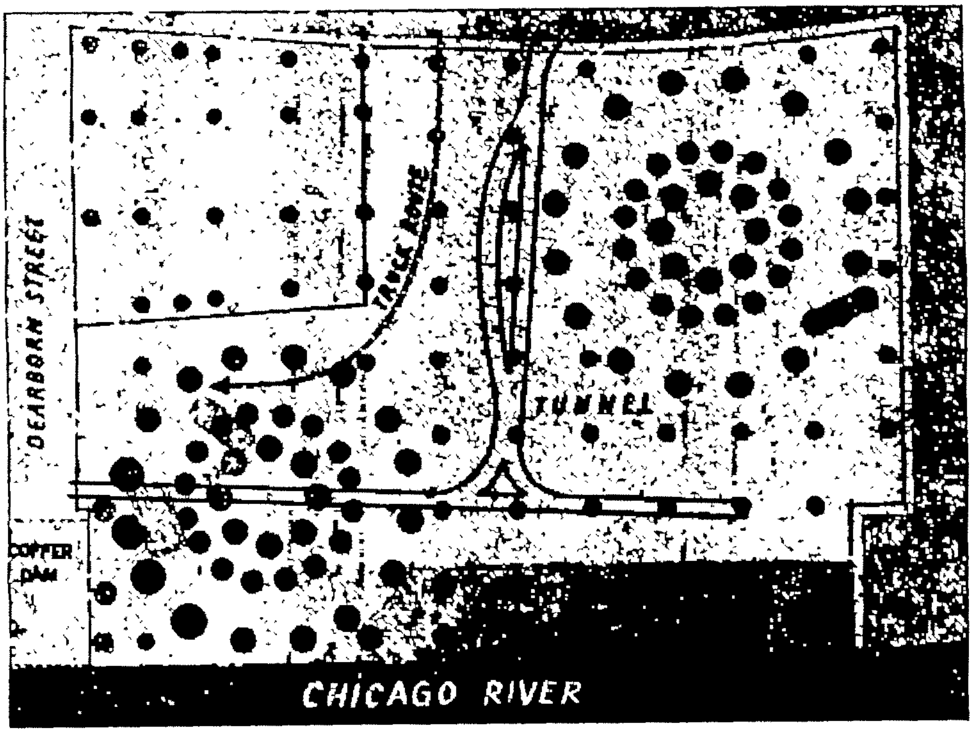


Fig. 4

General caisson layout and site plan

next to the Chicago River. Each tower is supported by three rings of 40 caissons, arranged in three concentric circles, with radii of 16 ft. 9 in., 23 ft. 6 in., and 54 ft. 8 in.

The inner ring comprises eight rock caissons and supports the core; the tops or the upper 45 ft. are 66 in. in diameter, heavily reinforced and are oversized or larger than the bottoms which are 54 in. in diameter, penetrate into rock 30 in. and are jacketed with a steel core barrel. Each of the caissons supports 4,260 kips.

The middle ring consists of 16 caissons. There are rock caissons, 48 in. in diameter at the top, with 42 in. core-barrel bottoms, and supports columns of 2,260 kips each.

The outer core of 16 caissons supports periphery columns and each caisson has a 60 in. top and a 52 in. bottom, and is designed to carry 3,530 kips.

The inner and the middle rings of the caissons are tied together with a 3 ft. reinforced mat. The outer core of the caissons are integrated with the inner core by radial tie beams and circumferential beams.

There are 158 caissons, of which 80 are in the towers. The other 78 caissons for other facilities are of constant diameter and range in diameter from 24 to 36 in. All the caissons are to rock, approximately 114 ft. deep. The tower caissons penetrate rock by 30 in.

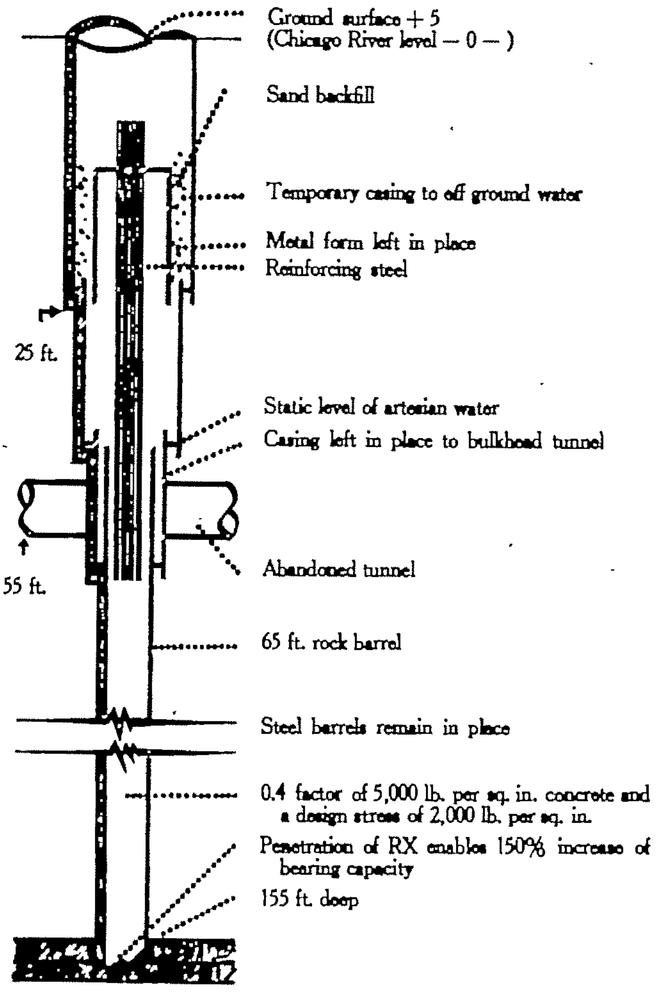

Ground surface + 5
(Chicago River level — 0 —)
Sand backfill
Temporary casing to off ground water
Metal form left in place
Reinforcing steel
25 ft.
Static level of artesian water
Casing left in place to bulkhead tunnel
Abandoned tunnel
55 ft.
65 ft. rock barrel
Steel barrels remain in place
0.4 factor of 5,000 lb. per sq. in. concrete and a design stress of 2,000 lb. per sq. in.
Penetration of RX enables 150% increase of bearing capacity
155 ft. deep

Fig. 5

A typical caisson

Due to fill ground of poor classification in the immediate vicinity of the Chicago River and the use and re-use of the then-existing quay wall, all the caissons were reinforced from top to bottom for bending.

Many of the cutoff elevations of the caissons were below river level. Many caissons were reinforced at the top 40 ft. This portion of the caissons was designed as a rigid beam, enabling the caisson to resist bending moments, rotate about the point of overturn, and dissipate the horizontal moments into the passive resistance of the ground. Therefore, it would be advantageous to have the upper portion of these caissons in large diameters. In order to maintain excellent access to the site and to each caisson location, and further to enable the Chicago and North Western Railroads to keep their tracks in operation, the caissons were installed from the upper level or elevation plus 5. This eliminated sheeting, bracing and dewatering during foundation construction. Heavy steel shells were installed through the fill. In order to eliminate the loss of ground and facilitate placing and later withdrawal of the steel shells designed to withstand the hydrostatic head of the ground, granular ground and fill were mixed with a finely ground, dehydrated montmorillonit clay. Water was added and a powerful auger which developed up to 1,600,000 in.-lb. of torque agitated the sand and mixed the clay. Sufficient water was added to surpass the liquid limit of the clay. Each sand grain was covered with a film of clay whose liquid limit was surpassed ; and the sand grains were separated and held in suspension. Therefore, the angle of internal friction was reduced and friction minimized. This permitted the installation of large diameter (up to 9 ft.) steel shells which were pressed and rotated into the *in situ* clays below. This effected a complete shutoff of the river water, and the caisson could then be drilled down rapidly (rates up to 50 ft. an hr.) to the boulder till. The hard pan had to be penetrated. The unconfined compressive strength of the hard pan was as high as 8 tons per sq. ft., and this offered great resistance to 6 ft. diameter bits. Occasional boulders ranging up to 3 ft. in diameter were encountered above, in and below the hard pan. With the surface water shut off by steel shells pressed into impermeable clays, it was safe to lower miners into the shaft and remove the boulders with rock drills and paving breakers.

At twenty caisson locations, an old, abandoned freight tunnel was encountered at an elevation of —55 ft. The tunnel had accumulated water through the years, and pumping and dewatering were not practical. Therefore, the extremities of the tunnel were bulkheaded and the tracks were removed. Special core barrels of the required diameters were used to core through the tunnel. After tunnel penetration was made, a Manitowoc-3500 crane repeatedly dropped a 10-ton star bit and pulverized the cored-out tunnel sections. A steel shell was then slipped into place which bulkheaded the tunnel.

Exhaustive testing indicated that the artesian waterhead on the top of the rock could be maintained throughout the site at about 60 to 65 ft. by minimum pumping. There was pumping in the area by others that also helped to maintain this level. It was not practical to drill out the entire shaft through the boulder till. Economical hand-mining operations could not be employed because the water head would have to be lowered either by air pressure or pumping. Working under air pressure to contain hydrostatic water at depths of 100 ft. offered many complications in completing the caissons and free pumping of the glacial till would create loss of ground. Running water makes the fine sand and silt quick and is readily pumped in great volumes by new electric pumps. Silt is very abrasive and quickly wears the impellers of the pump. When the pump fails, the water rises, eroding the silts, and when a new pump is installed, the suspended silts are pumped out.

The case method solution to this problem was the use of core barrels. Large diameter barrels employ the same principle as a diamond core barrel but range in diameters over 6 ft. and use carboloid tungsten slugs in place of industrial diamonds. The core barrels were made up in lengths of 65 ft. When installed into rock and sealed, the hydrostatic head would be lower than the top of the core barrel. The core barrels are designed to make the torque of the drill rig. Enormous torque is required to drill or core through boulder till and limestone. The unconfined compressive strength of the limestone ranges well over 10,000 lb. per sq. in. The foundation consultants agreed that a 30 in. penetration of the Niagaran dolomitic limestone would enable a bearing capacity of 150 tons per sq. ft. or 300 kips. By leaving the core barrel in place after rock and boulder till penetration and by the use of Baroid drilling muds, a satisfactory water seal was made, the rock being relatively impermeable. The core barrels are made of rolled plate steel, reinforced with heavy steel rings every 6 or 8 ft. The rings withstand the hydrostatic pressures and the steel shell acts as a diaphram. The upper portion of the core barrel is adapted to take a crosshead attached to the drill kelly of the drilling machine. This portion of the shell which adapts to the drill kelly is reinforced to take the torque and distribute it throughout the core barrel. The extreme bottom or cutting edge of the core barrel is made of high alloy abrasive resistant steel. Usually, molybdenum-nickel alloy steels are used. Carboloid-tungsten slugs, whose hardness is nearly 9, are silver-soldered into the cutting edge and so placed that a kerf larger than the thickness of the steel of the core barrel will be produced. Thought and experience in the design of core barrels and cutting edges are very important and the design may vary with the depth of penetration, the diameter of the core, the height of water head, and the formation to be cored.

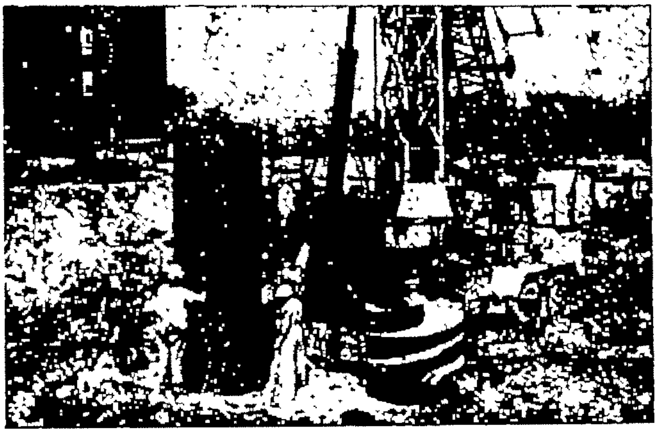


Fig. 6

Structural steel shell being inserted

The Marina site had non-cohesive boulder till deposits up to 10 ft. thickness. In some instances, the upper portions of the limestone bedrock appeared to be unsound and there were rock penetrations up to 4 ft. Generally, it took about one shift to core through the till and rock. Then mining crews took over. An air tugger and hoist were set over the caisson and by the use of electric submergible pumps, bails and air rock tools, the boulder till within the steel shell was broken and removed and the solid rock knocked out with heavy duty breakers and levelled. The steel shells prevented the entrance of silt and sand. In some cases, small amounts of clear water came through the fissures, cracks and joints between the core barrel and the rock. The core barrels were designed to be left in place. The height of the core barrel extended above the water level. The steel core barrel offers strong confinement to the concrete. Therefore, concrete of 5,000 lb. per sq. in. strength, a 6½-bag mix with pozzolith (designed for 6,000 lb.), was used. A concrete design factor of 0.4 and an ultimate design stress of 2,000 lb. per sq. in. or 288 kips per sq. ft., which approaches the 300 kips per sq. ft. allowable stress on the limestone rock, were used. The steel core barrel, therefore, is used as a construction tool and also as a foundation medium to increase the stress of the concrete, allowing a higher end bearing design on rock. In addition, the core barrel effectively shuts off artesian water and allows visual inspection and physical testing of the rock and concreting in the dry.

A qualified inspector from a testing laboratory went to the bottom of each caisson. With good lighting, he was able to inspect the physical condition of the rock. A plumb bob was lowered and the plumbness measured. Physical dimensions such as depth, caisson diameters, cutoff elevations, etc. were recorded on a form along with details of reinforcing steel check and concrete inspection, and then signed by all concerned.

In order to ensure proper placement and maintainance of the alignment of the reinforcing steel and to see that no deleterious elements contaminate the concrete, the upper steel shells cannot be removed until after the concrete is set. These steel shells are expensive, and a large diameter is desired so that more area can be resisted by the soil in dissipating horizontal moment. Therefore, the only use of heavy steel shells is to withstand the unstable ground and the high water table. A lightweight steel form made from 14-gauge sheeting is installed within the structural shell. It extends below the heavy shell and seals lightly in the soft clay below. This steel form does not have to be watertight. It is set by a transit and plumb bob and wedged exactly into place. The reinforcing steel schedule is then placed and can again be very accurately set. The concrete operations then follow and concrete is brought up and struck off at the exact cutoff elevation. The upper 20 ft. of the concrete is vibrated.

After the concrete is allowed to set, the space between the concrete form and the structural steel shell is filled with fine sand washed down with water. The outer diameter steel shell is readily pulled out and can be used over and over.

During the drilling operation of caisson 206 (an outer core caisson) in the east tower, a 5 ft. diameter auger broke off at the —107 ft. level on encountering large boulders, and water filled the hole. Attempts to remove the auger were not successful, and so additional 36 in. diameter caissons were put down alongside and a beam was placed across the two caissons to support the column.

Caisson 233 (an inner ring caisson, in the east tower) had a large granite boulder at — 90 ft. level and the removal of the boulder resulted in a 4½ in. eccentricity of the shaft. This eccentricity over the allowable was compensated for by reinforcing the shaft with thirty 11-0 bars in the bottom 60 ft. of the caissons.

Due to questionable and indeterminate matters, one of which concerned the line of sheeting for the coffer dam possibly encroaching 5 ft. in the Marina project real estate, caissons A-1, B-1 and C-1 were eliminated. The caissons in the outer core circle numbering 110, 111, 112 and 113 were changed in design wherein the rock core barrels are of full length or approximately 115 ft. long, 60 in. in diameter and of ½ in. steel plate reinforced with steel rings. This enabled the point of rotation of the caisson to be lowered; the caisson would be rigid and resist bending should adjacent construction weaken the ground. A 51-B drill rig weighs 120 tons, which weight is sufficient to cause displacement and movement of fill and soft clays in unfavourable conditions. So a temporary foundation was built to support the equipment and prevent such complications. For this foundation, two caissons each of 24 in. diameter, were installed with light equipment to —81 ft. and 4 ft. 6 in. bells were formed. A pad of reinforced concrete was installed over these supports and the equipment rested on this special foundation so that lateral pressures were minimized or eliminated.

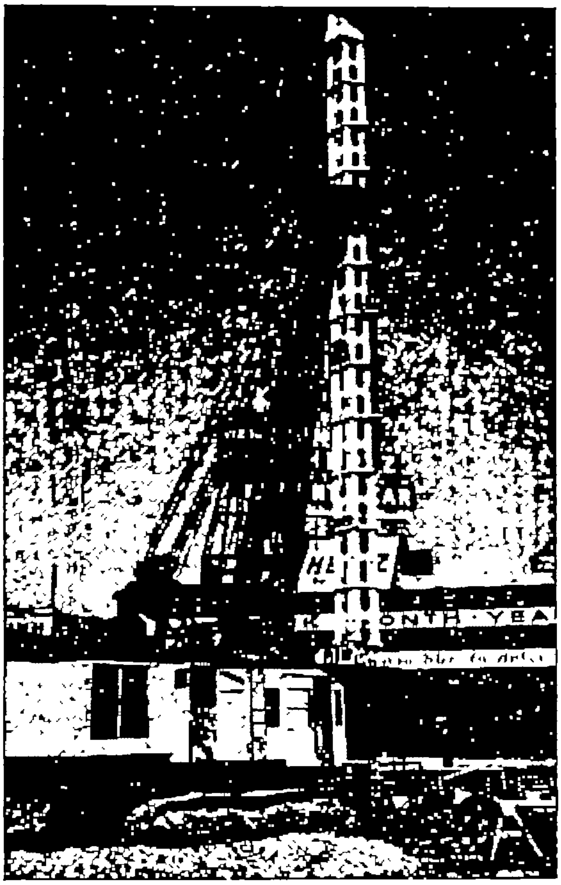


Fig. 7

A 51-B drill rig (the largest in the world) used to turn core barrels

At all times, a survey crew was measuring the lines and levels for subsidence and shift. There was no recorded settlement resulting from the caissons for the Marina project.

As usual, the plans for the old quay wall were not as built. The quay wall was tied off to concrete blocks capping timber piles. Several tie rods were cut during foundation construction, and the wall moved out as much as 27 in. Caisson 108 (an outer core caisson in the west tower) was thought to have moved. At this time, the contractor for the superstructure was on the site and was excavating, hauling with large trucks and was starting the initial work for the superstructure. This contributed lateral pressures. Incidentally, the last 2 in. round tie rod to be cut effected a pronounced twang sound of relief. Measurement indicated that the caisson may have moved to the south and 1½ in. to the west. There was concern about cracking and/or breaking of the caisson. A 9 ft. diameter shaft was mined, ringed and lagged to — 40 ft. Vertical 1 in. penetrations were chiseled into the concrete on the tension side and they were inspected closely for cracks. No cracks were found. The 9 ft. diameter shaft was sand backfilled. Excavation along the shore side of the quay wall relieved the structure, and if it had moved, it now righted itself. This circumstance had been wisely anticipated and therefore the caisson was designed for the resulting stresses. Caisson 227 (a middle ring caisson in the east tower) may have moved due to an adjacent 15 ft. cut and heavy equipment working at the upper level. A 4 ft. diameter shaft was dug alongside so that the caisson could be closely inspected. The caisson appeared to rotate in a circle clockwise, and if it had moved, it now righted itself. The 4 ft. diameter shaft may have relieved the stress in the ground.

Caisson 140 (of the inner ring) in the west tower was completed for a 437 ft. television broadcasting antenna to be placed on the top of the west tower. The other seven caissons of the inner ring were increased in size, with top diameters of 84 in., and the rock core barrels were 66 in. in diameter and made of ½ in. plate steel. Caissons 141, 142, and 143 supplement the completed caisson 140, and each is 30 in. in diameter with core barrels 60 ft. long, made of ¼ in. plate, with the upper portion of each caisson reinforced with twelve no. 5's and circular ties 9 in. on centre.

Caisson J-2 in the theatre area and immediately adjacent to the Chicago and North Western Railroad tracks revealed an abandoned covered railroad tank car 15 ft. down. The surrounding area was loose fill. Open excavation and obstruction removal was impossible due to the hazard that would prevail to the tracks and frequently passing freight trains. The caisson was mined through the tank car and bulkheaded.

A live high voltage electric line was found in the abandoned freight tunnel. Experienced miners wisely treated it like a hot line, and when it proved to be one, they too were quite surprised and alive.

ADDRESSES OF CHAIRMEN AT THE ANNUAL GENERAL MEETINGS OF THE LOCAL CENTRES

Madhya Pradesh Centre

Chairman's address by Prof. A. Lakshmanaswamy, D.C.E., B.E., C.E., M.R.S.H., M.ASCE., M.I.E., at the Fourth Annual General Meeting of the Centre on January 12, 1963

After welcoming the Chief Guest, B. A. Mandloi, Chief Minister, Madhya Pradesh, and other invitees, Prof. A. Lakshmanaswamy thanked the Committee of the Centre for electing him Chairman for 1962-63.

Delivering the Chairman's Address, he said, 'The major object of our Institution is the promotion of engineering knowledge with a view to developing research and providing experts in all the branches of engineering. After obtaining technical knowledge, the job of the engineer is to take from the scientists their discoveries and from the inventors their findings and to apply them for the use of the people and as a result, the need for the scientist-engineer is increasing. Obtaining his knowledge from scientist-engineers, man has travelled very far from his ancestors in the aspects of civilization. His inventive genius and constant application and perseverence have enabled him to work wonders. He is attempting a better living for mankind and is also probing into the mysteries of nature. In all the activities, the engineer has been playing an important part by constructing roads, railways, bridges, homes, engines, aeroplanes rockets, and the like. He does his work for the benefit of mankind irrespective of all other interests. In his work, he has to be a thinker, a dreamer and a philosopher in translating the thoughts, aspirations, ideas and the ideals of humanity. Our Institution is trying hard to do its best for the advancement of engineering knowledge.

It is customary for the Chairman to speak on this occasion about the work in which he is presently engaged and therefore I, being a civil engineer, propose to talk on the development and contribution of the science of soil mechanics in the field of civil engineering.

Foundations of structures and structures made of earth material are as old as human civilization itself. Most of the principles controlling their construction and behaviour have been known through decades, perhaps centuries, but these principles have been systematized and put together only in the past 25 to 30 years, to form a new branch of engineering knowledge called 'soil' mechanics'. In early 1920, there began a concerted effort to determine the physical laws for the behaviour of subsurface materials from which foundations derive their support. This has provided new techniques for selecting the types of foundation appropriate under a given set of conditions and predicting the performance of the completed structures. It has not decreased the importance of the accumulated experience of the ages but has defined the limits within which the traditional techniques are applicable and has provided new techniques suitable under the circumstances in which traditional techniques are not valid.

In recent years, the power of science has become apparent and there has been a tendency to discount the vast wealth of knowledge acquired during the past generations by trial and error. This attitude has been reflected by many institutions by reorienting courses in foundation engineering on a scientific basis. Thus, soil mechanics is a pioneer science which has grown rapidly during the last three decades and is generally accredited to Dr. Terzaghi who is called 'Father of Soil Mechanics'. Since that date, each year has seen the increasing popularity of this new subject, the number of soil mechanics laboratories has increased, more institutions have offered specialized courses in this new subject and the practical applications of this subject have become numerous during the recent years. It was officially given the name 'soil mechanics' in the First International Conference on Soil Mechanics and Foundation Engineering, held at the Harvard University in 1936. The Second, Third, Fourth and Fifth International Conferences on Soil Mechanics were held at Rotterdam, Zurich, London and Paris in 1948, 1953, 1957 and 1961 respectively. Our country also has contributed many papers for the above conferences and we are proud to say that one of our past-Presidents, Dr. K. L. Rao, represented India in the 1957 Conference and was elected a Vice-President of the Asian Region of the above society. These conferences are held to survey the developments made and to collect and coordinate the mass of information gathered by engineers and soil scientists, and to foster cooperation between practical engineers and soil research workers.

The Indian National Society of Soil Mechanics and Foundation Engineering which is the Indian section of the international body was founded in 1948 to promote and encourage the use of soil mechanics in this country. Since then soil mechanics has been a subject of study and research in many of the Indian universities and engineering colleges. A lot of work is being done on this subject at the Central Building Research Institute at Roorkee. In 1961, the Indian National Society of Soil Mechanics and Foundation Engineering conducted a symposium on 'Foundation Engineering' in collaboration with the Indian Institute of Science, Banglore, at New Delhi. The Indian National Society has been endeavouring to propagate and advance the science of soil mechanics throughout the country by publishing bulletins and by conducting symposiums, etc. Considerable progress has been achieved not only in the design methods but in the construction techniques also. Application of the principles of soil mechanics has brought remarkable economy in the construction of dams and other earth structures.

The importance of this subject to an underdeveloped country like India does not therefore require emphasis. It is a relieving thought that over the last decade an improved performance has been achieved in this sphere by the civil engineers who have made use of the new science to much advantage. Nearly 180 earth dams are either being constructed or are in the course of completion in the country at present. Several bridges, buildings, highways and airstrips have been constructed in very difficult foundations. Yet it is unfortunate that there has been no systematic collection of literature on this subject based on individual or collective experience on the problems encountered and the solutions for these constructional activities. Every one of us knows that the science of engineering has evolved only from experiences. Compared with the wealth of literature that some advanced countries have contributed by their publications, the progress of Indian engineers in this field is quite obscure.

The present day engineering design and construction practices manifest an increasing trend to incorporate scientific advancements with a view not only to complete the structures within the minimum time but to ensure a high degree of durability coupled with the maximum possible economy. The various branches of engineering and industry abound in examples of ever increasing applications of scientific principles in difficult spheres of investigation and construction. To cite an example, the old type of earth embankment which used to be a loose uncompacted mass of earth has made way to the zoned embankment of the rolled fill type of earth dam. More and more attention is being focussed these days on proper methods of design and construction based on the utilization of the applicable principles of soil mechanics. Information on the conditions and engineering properties of earth materials and their interpretation on a rational basis should be of immense help to engineers for elaborating on the design specifications, etc. and also during the actual construction. In the symposium on 'Load Bearing Capacity of Soils' organized by the National Buildings Organization in New Delhi in 1961, about 200 delegates from all over the country and from various foreign countries discussed about 34 papers, of which 11 were presented by authors from Japan, the U.S.A., the U.K. and the U.S.S.R. In the symposium, it was concluded that further work on moisture, bearing capacity relationships should be conducted in view of the Indian climatic conditions. While discussing a paper on pile foundations it was brought out that physicochemical and mineralogical properties of the soils also being very important, work should be directed in co-relating them to the load carrying capacity of the piles. Research was also considered necessary on the types of soils in which bored piles will be preferable to driven piles and *vice-versa.*

Design of earth dams

The highest earth dam at present is the Trinity dam in California and it is 536 ft. high and the proposed Oroville dam in California will be 730 ft. high or 4 ft. higher than the Hoover dam. The design of an earth dam includes use of drop inlets, emergency spillways and riprap for erosion control. A hydraulic jump may be utilized to decrease erosion downstream of the dam. Seepage may be reduced by the provision of a clay core, or, a clay core and cutoff, or, a clay core and an upstream blanket, or, by grouting. Seepage is calculated by means of the flow net and D'Arcy's equation.

Earthen embankments

Another design problem is the stability of the slope and this may be made safe by flattening the slope angle, incorporating toe drains, and avoiding sudden drawdown of the reservoir.

Frost action

It has been observed that severe damage to a cold storage building was caused by frost heaving. After 15 years of satisfactory service, the building began to heave up in the centre and in less than two years, the heave amounted to more than 1 ft. Temperature measurements showed that when the frost line penetrated to the footing level, the heaving became rapid. Corrective measures were taken up and the plant has come to its original level. Similarly, loss of bearing capacity of highways occurs due to changes in density and water content of the supporting soil which can be corrected by the application of chemical treatment to the soil.

Electrochemical hardening

It has been established that electro-osmosis combined with aluminium anodes results in an irreversible hardening of clays. With the prospects of cheap electrical energy in India in the near future, there is a great necessity for carrying out investigations regarding the basic principles involved in electrochemical hardening and its applications under Indian climatic and other conditions.

Computers in soil mechanics

An increasing amount of work is being done in applying electronic computers for solving soil mechanics problems such as the pressure distribution in soils beneath a large mat supporting loading.

Use of geophysics

Two geophysical methods are in use for exploring subsurface soils, *viz.*, refraction of seismic vibrations and electrical resistivity. Much of the time and expenditure can be saved by the utilization of geophysical principles in addition to the methods of direct exploration or exploring subsurface conditions to obtain information with regard to foundations, slope design, grading for highways, existing and potential landslides, and sources and extent of construction material deposits.

Other applications

Some of the other applications are as below :

(i) Electro-osmosis in drainage problems ;

(ii) Measurement of pressure distribution in soils by electrical methods ;

(iii) Determination of flow lines in seepage problems by electrical analogy methods ;

(iv) Vibration of foundations ;

(v) Radioactivity in determining the properties of soils ;

(vi) Vibration driving of piles for overcoming frictional resistance ; and

(vii) Problems of earthquake engineering, construction in swamps, drilling, dredging, tunnelling, etc.

Though much is being attempted, a lot of work is still to be done ; for instance, a problem like preparing charts for bearing capacities at various places and depths or a study of the different soil types and their properties will be of help to the designer. I hope that such problems will be taken up in the near future so that the science of soil mechanics will be of immense use in the economics of the projects in our Five Year Plans. In Madhya Pradesh, a lot of work in the field of soil testing for major projects *viz.*, the Bhilai Steel project, the Heavy Electricals at Bhopal and the structures of the State P.W.D. and the Electricity Boards is being conducted at the Government Engineering College, Jabalpur.

We should feel proud to belong to a profession which can render the greatest service to the country. In conclusion, let me exhort that we engineers, every one of us, should mobilize our talents, place them at the disposal of the motherland in this national emergency, and work as a team to carry out the duties with unflinching devotion'.

Uttar Pradesh Centre

Chairman's address by Shri K. N. Misra, C.E.(Hon.), M.I.E., at the 42nd Annual General Meeting of the Centre on December 30, 1962

After welcoming the Chief Guest, Shri C. B. Gupta, Chief Minister, Uttar Pradesh, and other invitees, Shri Misra thanked the Committee of the Centre for electing him Chairman for 1962-63.

Delivering the Chairman's Address, he said, 'When I took over as Honorary Secretary in 1955, we had a membership of 1,462, including students, Today we have 3,538 members. Similarly, from a small beginning in 1955, our Library has now over 2,000 books. Although our membership has greatly increased during the last seven years, a large number of engineers, eligible as they are, have not yet joined the Institution. I have no doubt that in the interests of the engineering profession, which has an important part to play in the progress of the country and in meeting the challenge of the aggressor from the north, every engineer will strengthen the Institution by joining it and energetically associating himself with its activities.

The Uttar Pradesh Centre started the construction of its building with the help of donations from its members and the Headquarters in 1954 and was able to have its library, reading room, office and committee rooms by 1957. At the opening ceremony of the library and reading room in that year, the then Minister for Finance, Shri Hafiz Mohammad Ibrahim, was pleased to announce that the Government of Uttar Pradesh would give adequate financial aid to complete the building and suggested that the Centre should construct a large and well built hall for its activities. Encouraged by this promise, the Centre revised its plans and started the construction of the hall. However, before long the Hon'ble Minister joined to the Union Cabinet and in spite of the help received from the Uttar Pradesh Government, the Headquarters and some other sources, the Centre not been able to complete the hall.

Some months ago, we gave a contract for the completion of the hall in the hope that a further grant would come from the Government, but to our disappointment and regret, the Government have declined our request for two successive years. We, of course, concede that in this hour of national emergency, avoidable new constructions should be put off so that all resources could be pooled and utilized for the defence of the country, but it is my submission that this principle should not apply to works which are not completed. Leaving incomplete works as they are is no real economy; at times it may well mean a national waste. Besides, it is now that we need more technical thinking and activity in order to train people to take up duties for the defence of the country. I therefore urge all members to make efforts to collect donations for the completion of the building. I also request our respected Chief Minister, keen as he always is for the advancement of technical knowledge, to give us his blessings for the success of our efforts and to supplement his good wishes with an adequate Government grant.

With a view to creating a technological and scientific tempo in the country, which is essential for a successful warfare, the Institution is going to undertake training of student apprentices, job men and technicians whether employed in national construction projects like river valley scheme hydro and thermal installations, or, in the sphere of industrial production. It is also proposed to start schemes of technical training in certain essential subjects for the benefit of students of local polytechnics as well as other candidates desirous of acquiring technical skill for the furtherance of the war efforts and the general service of the country. Broadly, the subjects to be taken up will include concrete technology, electrical practice, draftsmanship, survey and drawing, oil engines, road construction, drainage and water supply, automobile repairs, welding and machine tool practice. The Centre is mobilizing its efforts by seeking the cooperation of corporate members who have retired from service and others who volunteer for this work as a national duty. The training will be diversified in character and the staff chosen will be so arranged as to ensure that too great a demand is not made for their voluntary contribution in terms of time and energy.

The library of the Centre is open also to members the public and they can make free use of it. In order to serve its members and the public in a better way, it is proposed to extend the library working hours to the forenoon also.

At present, a number of polytechnics are run in the State under the administrative control of the Director of Technical Education. After a student has completed his studies, the initiative is left entirely to the polytechnic concerned for his practical training. With a view to improving the content of the training given in the polytechnics and to ensure technical efficiency of the trainees through different industrial units, the Centre will be appointing collaboration committees which would associate themselves with the various polytechnics. These committees will examine how far the efficiency of the candidates could be accelerated in relation to the outturn, and how far improved standards could be attained by the trainees. This Centre also hopes to assist the trainees by providing channelised information regarding employment opportunities in workshops, factories, industrial concerns or defence service installations. This Centre also proposes to supply notes and technical books, where necessary, in the furtherance of the training programme for technical personnel in the Armed Forces.

This is necessary in view of the fact that, due to frequent transfers, students associated with defence employment are at present handicapped by not receiving the literature required in time.

In the defence programme of the country, the engineers of the Public Works Department will be called upon to construct more roads in the border areas and to play a vital role in organizing civil defence. Similarly, the engineers of the Irrigation Department will be required to ensure that canals and hydro-electric projects are completed and maintained efficiently so that food production during the emergency is maintained up to the mark. Likewise, engineers of the Electricity Department will have to increase and organize their output in order to help in establishing industries commensurate with the defence requirements. Again, past experience tells us that in every country during such emergencies there is a rapid growth of industrialization and that unless such growth is properly thought out and planned, there is a great risk that things may take a haphazard and uneconomic shape. It will, therefore, be the endeavour of the Town and Village Planning Department to submit advice in the selection of industrial locations and preparation of the connected development plans. The army engineers are already working to their utmost capacity in order to meet the challenge of the day.

The engineers of Uttar Pradesh have a record of bright achievements in every sphere although they had to work under many limitations and handicaps. However in this democratic age, success is not enough. The achievements should also be known to the people so that they may realize the usefulness of an engineer and appreciate his contributions in the development of the country both in peace and in war. We should, therefore, utilize every opportunity to explain to the masses in their own language the public utility of the projects which we are executing, our methods of execution, our difficulties and the benefits which the projects are intended to provided. The start should be made with the worker himself. To him should be explained the importance of the project, its usefulness and the necessity for completing it by the specified date. On understanding the benefits of the project, he will naturally be willing to share the responsibility for its quick completion, and imbued with feelings of patriotism, he will leave no stone unturned to raise the project by the required date. For example, if the workers engaged in making roads on our northern borders are made to understand the implications of these works and their importance in the defence scheme, they will, I have no doubt, sacrifice personal comforts and complete the job not only in time but much ahead of the required date. By telling the public about the work that is being done, you will not only be educating them but would be serving the nation's cause by getting the job completed properly within the time schedule.

Lastly, it is hardly necessary for me to remind you that in this age of science and technology, real and abiding results cannot be achieved unless the scientists and technicians are associated with administration and planning in the technological field in a greater measure than has been the case hitherto. We all know that our Prime Minister and other distinguished statesmen directing the administration of our affairs have many a time publicly expressed themselves on these lines. This is a matter of satisfaction, but our regret is that so far adequate and concrete steps in this direction have not been taken by the Central or the State Governments. Scientists and technicians in our country have to depend by and large on the grace of the administrators, from whom they receive little encouragement—at times their legitimate interests are even suppressed. I need not take your time in elaborating this as it is common knowledge that the technical personnel have not so far received a fair deal. Unless the man who is responsible for producing results is allowed to make his contribution in the formulation of policies and has an opportunity of direct contact with the highest functionaries, we will not be able to achieve the measure of success which we all desire.

In this hour of national need, every Indian has a duty to perform. But whatever is done or left undone by those in power, the engineers are determined to make their fullest contribution to the defence of the country and the general promotion and advancement of engineering in India by all the means and mehods that are laid down in the Charter of 1935 by which the Institution of Engineers (India), established in 1920, was given the shape and dignity which it now enjoys.'

Summaries of Papers Published in the Journal, vol. 43, no. 12, pts. EL 6, GE 3 and HI 3, August 1963

ELECTRICAL ENGINEERING DIVISION

Generalized Circuit Theory of Electric Machines—2

C. V. Govinda Rao
Associate Member
and
R. M. Mathur
Non-member

Calculation of torque in electrical machines can be carried out either on the basis of Ampere's law or by using Boucherot's theorem. Of the two methods, the latter gives a more satisfactory treatment. Though the theorem gives a criterion whether a machine develops any torque at all, it does not guarantee successful working of the machine. This paper discusses the above aspect and deduces the necessary and sufficient condition for the successful working of any electrical machine. This condition is then applied to the known cases of electrical machines and the relevant results are obtained in a direct and straightforward manner. The merits and inadequacies of the theory are pointed out.

Tidal Power Schemes

B. R. R. Iyengar

Member

It is a well known fact that the rise and fall of tides in the ocean give rise to a stupendous amount of energy. Attempts have been made since the earliest times to harness this energy by installing tidal mills. In recent years, the more advanced countries are again giving serious thought to this problem as they are fast exhausting their conventional sources of energy. The recent developments in the 'bulb' type turbines which can function both as turbines and as pumps has given a great fillip to tidal power schemes. A number of schemes have been investigated in many parts of the world. Work on the Rance Estuary scheme in France has already begun and will probably be the first tidal scheme to be commissioned commercially. In India, though we have not yet exhausted our conventional sources of energy, it cannot be denied that in the next decade or so, serious thought will have to be given to the problem of harnessing other sources of energy, one of which is the tidal source.

The planning and execution of tidal schemes take anything from 10 to 12 years and hence right from now, we should start equipping ourselves with the technical knowhow of tidal schemes. As a first step, a reconnaissance should be carried out to explore possible sites and a pilot plant may be set up in a suitable creek to enable more data to be collected on the various aspects of tidal power installations as applicable to local conditions.

Load Curve of Single-Phase Induction Type Watthour Meter

P. V. N. Ramanathan

Associate Member

The electricity meter forms an important link between the supply undertaking and the consumer. Due to various reasons, it is impossible for a meter to register without any error throughout its range. The factors influencing the load curve at low as well as overload ranges are discussed. The order of magnitude of the errors and the usual methods employed for compensating these are indicated. The design of a meter with a overload capacity of 400% or 500% was made possible by using a magnetic shunt.

Engineering Magnetohydrodynamics with Particular Reference to Energy Conversion

P. S. Satsangi

Non-member

This paper deals with the general ideas of magnetohydrodynamics including a list of a few and foremost applications of this subject in the engineering field, and the basic but simplified equations governing it. Magnetohydrodynamic (MHD) energy conversion techniques are summarized, and the principal characteristics and capabilities of a MHD generator are discussed. In conclusion, the opportunities for work available in this area have been emphasized and concerted effort on a national scale advocated to meet the challenges posed. A fairly comprehensive bibliography on the energy conversion aspects of magnetohydrodynamics is added.

GENERAL ENGINEERING DIVISION

Educating the Engineer of the Future

Prof. R. M. Advani

The paper presents the opinion of the author with regard to the system of technical education to be given to the engineer of the future.

Improving the Effectiveness of Engineers and Scientists in India

S. Balaram

Associate Member

The paper focusses attention on the important problem of improving the effectiveness of scientists and engineers. The present conditions of employment of engineers and scientists as well as the conditions of contemporary engineering and scientific education are analyzed. The analysis reveals that the present conditions of employment of engineers or scientists are far from attractive. For instance, an entrant to the administrative service has twenty-three times the chances of an engineer entering the corresponding civil service, of reaching a salary level of Rs. 1,800. Measures for remedying the adverse conditions of employment as well as the unsatisfactory state of engineering and scientific education are suggested. One of the specific steps suggested for encouraging higher levels of attainment in engineering is the granting of awards by professional associations like the Institution of Engineers (India), which may be termed Associate Fellowship and Fellowship based on research work, to correspond to the post-graduate research degrees of universities.

Educating the Engineer of the Future

P. C. Chakravarti

Member

The paper presents the opinion of the author with regard to the system of technical education to be given to the engineer of the future.

INDUSTRIAL ENGINEERING GROUP

Role of Industrial Engineering in Management

S. J. Jain

Associate Member

The essence of engineering is to change something but, as its definition implies, the change must be made in an economic manner. This emphasizes the economic aspect of the change, and the engineer has to be conscious of it. An engineer has to gauge the effects of a process on persons and the society beforehand, so that the process suits the conditions and environments, as far as possible. This involves a grasp of the significance of the economic aspects of engineering and an understanding of the fundamental relationships involved in putting engineering to fruitful use. It also means the inclusion of economic analysis and 'human aspect' analysis as an integral facet of engineering application. In other words, the efficiencies of the economic cycle depend entirely on the organization and management which direct the use of funds and credit. This brings us to the objective and philosophy of management. No organization can work efficiently and remain on the right path, without a predetermined goal, a philosophy and a plan of action. Thus, the overall goal is an intelligent, well established enterprise, organized to return continued maximum benefit to the employer, customers, shareholders and suppliers.

Nuclear Fission in War and Peace

S. S. Jaswal
Student

In 1939, Hahn and Strassman concluded that in the bombardment of uranium (U-235) by neutrons, absorption of a neutron by a uranium nucleus caused it to split into fairly equal parts with the release of a terrific quantity of energy. Here was that the first genuine case of complete 'nuclear fission'. By 1940-41, it was known by the fission of 1 kg. of U-235 the energy released is equivalent to that caused by the explosion of no less than 20,000 tons of T.N.T. and the result took the shape of an atom bomb. Science may be proud of this achievement, but it is far from in that it has given to humanity a means, which, if misused, is capable of destroying the civilization.

Properly used, nuclear fission will do much to make the world a better place by providing new sources of energy for a large number of beneficial purposes. A number of industrial installations such as automobile, petroleum, paper, rubber, textile and metal working plants are making use of nuclear energy. For agricultural and medical purposes, the use has already been considerable. For the present, the most essential and immediate consideration is that the advances which science has made in physics, chemistry and biology should no longer be used as a destructive weapon. Peaceful uses will bring the world on the threshold of a new era of progress. Every echo should recall 'atom for peace'.

Assessment and Control of Thermal Environments in Indian Factories—Practical Concepts and Field Studies

N. L. Ramanathan
Non-member

M. S. Chakravarthy
Non-member

and

R. N. Mukherjee
Non-member

In tropical countries like India, environmental heat stress imposes considerable demand on the heat regulation mechanism in man. Under such conditions, the additional heat load due to industrial operations constitutes an added burden, which, in extreme cases, becomes well-nigh intolerable. Apart from the direct hazards of heat exposure, *viz.*, heat stroke and heat cramps, the insidious effects of accelerated fatigue, enhanced accident risk, and cumulative production drop assume great significance. While the physiological aspects of the problem are yet to be fully understood, physical methods of heat control, based on the well known laws of heat transfer, have been evolved. Therefore, it only remains to study the heat problem in any factory, traces the cause of the stress and apply appropriate control procedures for the suppression of unwanted heat oppression.

In this paper, the scientific approach for relieving the thermal stress under Indian conditions is presented. Practical measures for heat control in Indian factories are discussed and some field studies to illustrate these principles are quoted briefly. The design of thermal control procedures have to be based on thermal observations of the environment for establishing a heat load situation and analysis of the contributive factors, which may be any one or a combination of factors radiant heat, air movement, humidity and air temperature. A heat stress condition is said to exist when the effective temperature derived from environmental measurements exceeds 80°. It is suggested that above 80° E.T. reduction of heat stress is desirable and above 80° E.T. control measures are mandatory to ensure that the untoward effects of heat are at the minimum levels. The limits of 80° and 85° E.T. proposed here are, in general, considered to be suitable for factories in India and are compatible with the practical aspects of the problem.

HINDI SECTION

Practice, Progress and Utilization Potential of Irrigation in India

Baleshwar Nath
Member

Irrigation is practised in India in varying forms since ages. The paper explains how cropping seasons in India are governed by the irrigation facilities available in different parts of the country, how the irrigation works built in the past centuries dating as far back as 300 B.C., have gradually progressed through different historical periods, how works started on canals like the western and eastern Jumna during the Mughal times had been improved upon during the intervening centuries, and how their irrigation potential has increased from a few thousand acres to many lakhs now.

During the British period in the 19th century, a large number of irrigation works utilizing the surface water of rivers had been constructed. This development was followed up even in the 20th century consequent upon the report of the Indian Irrigation Commission of 1901-03, which considered that irrigation alone could meet the menace of famines. The progress during post-independence period, *i.e.*, under the Five Year Plans, has been strikingly significant.

As a result of the progress made in this direction, India stands in respect of irrigated area almost at the top of all the countries in the world leaving out China. In fact, in the field of irrigational engineering, it is considered a leading country, but its productivity per acre even from irrigated agriculture is low. This aspect has caused considerable concern to the planners of today, who are worried about the food production in the country for the ever increasing population. While famines gave a fillip to irrigational development during the past century, it is the increasing population and the increased requirement of food that are at present leading to more and more irrigational facilities being provided throughout the country, though the financial returns from many of the new projects are not promising.

The paper gives the extent of area irrigated from different sources in the country and what a small percentage it still is of the net area shown. Even the potential so far created has not been utilized fully in spite of the pressing need and irrigation for agricultural development in the different States of India. The author points out the urgent need for a coordinated effort on the part of State agencies and the irrigating public to make the fullest use of the irrigation facilities available, so that the food production effort of the country can be boosted up.

Bamboo and Its Use in House Construction

G. C. Mathur
Non-member

The paper describes the sources and different varieties of bamboo, and its use in the construction of cheap houses. Methods of chemical treatment of bamboo to prolong its life and make it more durable are described. Various methods of its use in the construction of the different parts of a house have been dealt with, and use of bamboo for other house-hold purposes is also mentioned.

Performance Study of a Single Stage Axial Flow Compressor Using Simplified Blades

C. B. Misra
Non-member

A single stage axial flow compressor using simplified blades was designed and constructed, and its performance under varying speeds was studied. As a result of experiments, it was found that increase of pressure, efficiency and work compare favourably with the theoretical values of the cascade as calculated on the basis of Havell's method. The loss coefficients in the compressor and the cascade was found to be nearly the same. The work done through the simplified blades was also the same in the compressor and the cascade. On the basis of these results, it has been concluded that such simplified blades can be very useful in some special cases.

Sir M. Visvesvaraya

Vishwambhar Prasad
Associate Member

This paper traces the life of the illustrious Indian engineer, Sir M. Visvesvaraya. It explains how swiftly he rose on the official ladder from the position of an assistant engineer to the office of a superintending engineer by his hard work and initiative. After premature retirement from the Bombay P.W.D., he became Chief Engineer in Mysore State and eventually Dewan, and was responsible for the construction of the Krishnarajasagar dam and reservoir across the Cauvery, built at a cost of two crores of rupees. The Mysore Iron and Steel Works at Bhadravati also owes its existence to him. After retirement from Mysore in 1918, he served on several important committees of the Government of India, and engaged himself with the task of planning of an industrial India. The automobile Industry was started in the country on his initiative and he was the founder of the All-India Manufacturers Association, to which he remained President till his death in 1962 at the age of 101 years.

Summaries of Papers Published in the Journal, vol. 44, no. 1, pts. CI 1, ME 1 and ET 1, September 1963

CIVIL ENGINEERING DIVISION

Vertical Stress Computation in the Soil by Westergaard's Equation

K. B. Agarwal
Non-member

This paper deals with the problem of estimating the vertical normal stresses in elastic foundations, particularly in the case of sedimentary soils. Influence charts for Westergaard's solutions are presented for loading conditions which are frequently encountered in building settlement investigations, *viz.*, for the case of loads applied at a point on the surface and distributed uniformly over rectangular and circular areas. Influence charts for these loading conditions on the basis of Boussinesques' equation have been previously published and these have also been used for comparison of Westergaard's equation with Boussinesques' equation.

Experimental Investigation of Wave Action on Sand Beach

S. N. Ghosh
Non-member

In the design of harbours and in coastal erosion problems, it is necessary to study the effect of waves on the sand beach, especially the factors that control its equilibrium and stability. As it is very difficult to stimulate the exact field conditions in the laboratory, a basic study of the problem is attempted in order to find out the effect of depth of water, initial slope and wave amplitude on the equilibrium slope. The investigation was carried out in a flume in the hydraulics laboratory of the Indian Institute of Technology, Kharagpur, on a model with the help of a suitable wave generator. The study revealed that the beach not only depends on wave amplitude but also on the initial depth and slope provided, and the equilibrium slope is independent of wave amplitude.

Coefficient of Discharge for Standard Sharp-Crested Weirs

Prof. N. S. Govinda Rao
Member
and
D. Muralidhar
Non-member

This paper presents simple formulæ for flow over standard sharp-crested weirs based on the analysis of experimental data and formula obtained by several investigators. The formulæ express the coefficient of discharge as a function of wetted perimeter of the notch portion.

Earthquake Resistant Design of Earth Dams

Jai Krishna
Member

Design of structures in seismic areas is a problem which presents many practical difficulties due to uncertainty with regard to the origin, time, frequency, intensity and duration of future earthquakes. An estimate of the forces is based on the past history of the region and the structures designed on this basis can be expected to resist shocks better than those not designed for earthquake forces. It cannot, however, be said that such structures are earthquake-proof because in case the future shock happens to be a big size (or, it occurs very close to the structure) such that the ground motion is more intense than that anticipated in the design, damage could occur. In the case of dams, this element of risk has to be examined more carefully ince the failure of a dam is far more disastrous to a community than that of other structures. This paper presents the analysis of the problem of design of earth dams in seismic zones.

Testing of Clay Building Bricks

D. Johnson Victor

Associate Member

The various tests for common building bricks prescribed by the Indian Standards Institution and the British Standards Institution are discussed. The practical difficulties encountered while conducting the prescribed tests are enumerated. An alternative method of test for determining the compressive strength of bricks is proposed. This method gives the least coefficient of variation and effects considerable saving in space, time and expense. The rate of water absorption with time is studied and an empirical relationship between time in hours and percentage absorption is suggested.

Hydraulic Design Criteria of Simple Type Wave Generators

Nikhilesh Roy

Non-member

and

S. N. Ghosh

Non-member

In spite of the numerous recent developments in the design and fabrication of a near ideal water wave machine, the simple flap type (hinged at base) and piston type machines are still widely used because of their inherent mechanical and operational simplicity. In this paper, the operational characteristics of these two machines are derived from the airy-wave theory and the theoretical performances compared, graphically, over a wide range of water depth-wave length ratio. A numerical example illustrating the use of the design curves is appended at the end.

Dynamic Formula and End Bearing Piles

Y. S. Sane

Associate Member

When a point bearing pile encounters a firm stratum, the penetration resistance increases sharply. This observation has led to various attempts to express a relationships between the bearing capacity of a pile and the penetration resistance under the last few blows of the hammer, which are known as 'pile formulæ'. The paper first outlines the purpose of these dynamic formulæ and their requirements in general. Observations were made regarding some particular types of piling systems at Greater Bombay where the dynamic formulæ were used to evaluate the allowable load on the piles. The limitations and drawbacks of some of the formulæ are discussed with reference to the particular cases studied and some aspects of application of the formulæ are explained. In the case of end bearing piles founded on firm rock, the dynamic formulæ are the criteria to ascertain whether the piles are driven to the required bearing rather than to evaluate the resistance of a particular pile.

A Series Solution for Beam Problems

Dr. K. T. Sundara Raja Iyengar
Associate Member

and

S. Anantharamu
Non-member

A series method is explained for solving the problem of bending of beams for all common types of end conditions. The method has been extended to the analysis of continuous beams also and further, the method is applicable to any arbitrary type of loading on beams. Beams with variable moment of inertia are also considered and numerical examples are worked out to illustrate the method.

RAILWAY ENGINEERING GROUP

Development of Bogies for Railway Rolling Stock

P. C. Neogi
Member

The Indian Railways with a network of 35,000 track-miles in three gauges form the largest railway system in Asia. It handles a wide variety of freight traffic which is rapidly expanding with the increasing pace of industrialization and has risen from 114 to 168 million tons per year in the Second Plan, with an expected increase to 260 million tons after the Third Plan. The fleet of freight cars is consequently not only large but consists of different types such as open cars, covered cars, 4-wheelers, bogies, etc., to suit the commodities to be handled. A programme of modernization is on the way to make their designs more efficient from the point of view of economy, speed and safety. This paper traces the developments in the design of bogies for railway rolling stock.

ROADS AND ROAD TRANSPORTATION GROUP

Some Suggestions for Improvement in Construction Technique of Future Concrete Roads in India

Dr. M. L. Puri
Non-member

and

N. R. Srinivasan
Non-member

The necessity for stepping up both quality and speed of construction to cope with the increasing demand for structural soundness of furure concrete roads in India, which are subject to heavy traffic, is stressed. For this purpose, employment of varying degrees of mechanization is suggested. Some data regarding the machinery to be employed for jobs of different magnitudes, the initial outlay, details of organization and operation, etc., are given. Rough estimates of cost of construction with different degree of mechanization has been worked out and discussed. Besides mechanization, the other ways in which improvements can be affected are also explained. Based on experience in India and elsewhere, a case has been made out for gradual and systematic mechanization of concrete road construction while keeping an eye on the employment as well the cost questions, with a view to provoke discussion among highway engineers in India on this controversial subject.

MECHANICAL ENGINEERING DIVISION

Power Plant Superheater and Its Design Criteria

S. Roy
Non-member

Steam still remains to be the only practical medium for converting heat into the enormous amount of power demanded by power industry. With the introduction of reheat and supercritical pressures, the overall efficiency of steam power plants is now reaching 40%; and the problem of superheating and reheating is becoming complicated particularly for high temperature applications. This paper deals with the design criteria of power plant superheaters.

Dimensioning in Interchangeable Manufacture

V. L. N. Row
Member
and
Kosla Vepa
Non-member

In recent years with the advancement of modern manufacturing techniques and improved methods of production primarily aimed for greater output and mass production, there has been a lot of rethinking with regard to the topic of dimensioning with interchangeable tolerances. It had so far been the practice to relegate this responsibility of giving the dimensions to a draftsman but with the use of different systems of tolerances and the wide range of fits and limits for interchangeability, this part of machine design has now developed into an exact science and is no longer subject to the individual vagaries of a draftsman. Dimensioning has a great effect on tolerance problems, the method of manufacture, the type of fit desired, and last but not least, on the basic principle of interchangeability which is so vital for mass production. It is elementary knowledge that any machine part cannot be manufactured to its exact size and a working tolerance is essential. This brings in its wake the question of choice of a suitable system of limits and fits.

Combustion in a Spark Ignition Engine

A. P. Agarwal
Non-member

A. Venkata Raman
Non-member

and

K. D. S. R. Somayajulu
Non-member

In this article, combustion has been reviewed from the mathematical, physical, chemical and molecular viewpoints. Some problems leading to combustion in engines are briefly discussed. The various factors including 'knocking' which come into consideration are indicated.

ELECTRONICS & TELECOMMUNICATION ENGINEERING DIVISION

Optimum Bandwidth Design by Combined Positive and Negative Feedback

J. G. Advani
Non-member

Multiloop feedback circuits employing positive current feedback in minor loops and overall negative voltage feedback are designed for maximally flat gain response. Two circuits, one having two *R-C* coupled pentode stages and another having four *R-C* coupled pentode stages are discussed. To secure an overall negative voltage feedback, one extra amplifier of unit gain having a practically flat response over a wide range of frequencies is incorporated in both the circuits. Positive and negative feedbacks are adjusted to give the same midband gain for the multiloop feedback circuits as the midband gain of corresponding circuits with no feedback at all.

The optimum values of x, the positive feedback factor, are determined and the bandwidth for the two-stage circuit is found to be ω_2 where for the four-stage circuit it is 0.628 ω_2, and the bandwidths for corresponding circuits without feedback are 0.643 ω_2 and 0.345 ω_2 respectively. Here ω_2 is the bandwidth for each *R-C* coupled stage.

The feedback path yielding the overall negative feedback is made frequency dependent and a parameter y, depending on the elements of feedback circuit, is defined. The optimum values of x and y are found for the two multiloop feedback circuits. The optimum values of x in both the circuits are found to increase and the bandwidths of the circuits increase to 1.7 ω_2 and 0.753 ω_2 respectively. It is observed that the

sensitivity and $\frac{\text{Signal}}{\text{Noise}}$ ratio are also improved in multiloop feedback circuits. Circuits using the optimum values of x and y are found to be stable.

Design of Low-Pass Stagger-Loaded Amplifiers

V. K. Arya
Non-member
and
B. Prasad
Non-member

Criteria are available in literature for a choice among the various forms of wideband low-pass amplifiers available, *i.e.*, shunt-peaked maximally flat amplifiers, Butterworth stagger-loaded and distributed amplifiers. The present work extends the criteria to Tchebycheff stagger-loaded amplifiers and goes on to show that these can, in most cases, replace the amplifiers of the Butterworth type. Various curves and tables are included to facilitate choice of form of the amplifier and also the design of the proper interstage network to meet the requirements of specified gain and bandwidth.

Speed of Transmission of Phonetic Printed English

S. Balaram Rao
Associate Member

It is known that the use of a phonetic alphabet for the English language instead of the existing alphabet results in a saving of the number of letters required to print or write out a given message. The purpose of the paper is to evaluate the economy in transmission time that results from the use of a phonetic alphabet on printing telegraph channels. It is shown that the use of a phonetic alphabet results in a reduction of 12% in transmission time.

Phase Compensation of a Third Order Type-1 Control System

V. Seshadri
Non-member

A typical third order type-1 position control system is described. The various considerations involved in phase-compensation by means of a lead network are discussed. For different values of lead network ratio and gain crossover frequency, the system performance, as represented by the phase margin, is obtained by digital computation and a generalized chart is developed as a design aid for the choice of the most suitable network. A generalized procedure for the phase compensation of a third order type-1 system is presented.

INSTITUTION NOTICES

Acceptance of Studentship Examination of the Institution as qualification for Emergency Commissions

Following correspondence between the Secretary and the Army Headquarters, it has been announced that the candidates who have passed the Studentship Examination of the Institution will be eligible to apply for Emergency Commissions.

Change in Programme of Associate Membership Examinations (New Scheme), November 1963

As Saturday, November 16, 1963, is declared as a holiday in some parts of India, examinations in the following subjects scheduled to be held on that day will now be held on **Tuesday, November 19, 1963.**

Associate Membership Examination—Section B (New Scheme)

	S. T. 10.00 a.m. to 1.00 p.m.	**S. T. 2.00 p.m. to 5.00 p.m.**
Tuesday, November 19, 1963	Thermal Power Engineering Servomechanisms	Production Technology and Industrial Engineering Principles of Semiconductors and Transistor Circuits

INSTITUTION NEWS

Proceedings of the Sixth World Petroleum Congress, Frankfurt, June 1963

The Sixth World Petroleum Congress was held in Frankfurt-on-Main, West Germany, from June 19 to 26, 1963. The proceedings of the Congress are published in nine volumes: (i) General Volume, (ii) Geophysics and Geology, (iii) Drilling and Production, (iv) Processing and Refining, (v) Base Stocks for the Chemical Industry, (vi) Composition Analysis and Testing, (vii) Utilization of Petroleum and Natural Gas Products, (viii) Engineering, and (ix) Statistics and Education. The cost of any single volume is DM 60 and the cost of a complete set is DM 480.

Orders for this publication should be addressed to Verein zur Forderung des Sechsten Welt-Erdol-Kongresses e.V., Alsterufer 50, 2 Hamburg 36, West Germany.

FORTHCOMING CONFERENCES

Seminar on 'Carbon and Carbon Products', New Delhi, November 1963

A four-day Seminar on 'Carbon and Carbon Products' will be held during the last week of November 1963 at the National Physical Laboratory, New Delhi. The scope of the seminar has been divided into four sections: (i) Raw materials including binders, (ii) Carbon technology, (iii) Testing of carbon products, and (iv) Equipment for manufacture.

The National Physical Laboratory has been engaged in developing products such as brush, blocks, rings, telephone arresters, dry cells, rods and cinema arc carbons. The purpose of this seminar is to bring together the diverse interests connected with the development, manufacture, supply and use of carbon products and to provide for an exchange of views.

Members who wish to contribute papers should send a summary of the paper to the National Physical Laboratory, Hillside Road, New Delhi 12, by September 15, 1963, and by the complete paper by October 15, 1963.

Symposium on 'Interconnected Power System Operation in the Eastern Zone', Calcutta, December 1963

A-Symposium on 'Interconnected Power System Operation in the Eastern Zone' will be held in Calcutta during the third week of December 1963 on the occasion of the 43rd Annual General Meeting of the Bengal Centre of the Institution. This Symposium in jointly sponsored by the Bengal Centre and the *Indian Journal of Power & River Valley Development*. The last date for receiving papers has been set as November 30, 1963.

Further details can be obtained from the Honorary Secretary, Bengal Centre, The Institution of Engineers (India), 8 Gokhale Road, Calcutta 20.

Convention on 'Productivity in Local Government', London, October 16, 1963

The Institution of Municipal Engineers, London, has organized the fourth autumn Convention on 'Productivity in Local Government' on October 16, 1963. Sir Keith Joseph, Minister of Housing and Local Government, U.K., will open the Convention and address the delegates. The delegate will have an opportunity to hear papers presented by experts and to exchange the latest ideas in productivity in Local Government as applied to the municipal engineering field.

Further details can be obtained from the Secretary, Institution of Municipal Engineers, 25 Eccleston Square, Westminster, London, S.W. 1.

World Space Communication Conference, Geneva, October 1963

The International Telecommunication Union (ITU) will hold the International Space Radiocommunication Conference in Geneva for five weeks from October 7, 1963. Forty-three member countries of the ITU will participate in the conference.

The idea of holding this conference goes back to the ITU's Administrative Radio Conference in 1959. On that occasion, a certain number of radio frequency bands were allocated for space research purposes, and these have been subsequently used for the various communication needs of outer space operations, including telecommand, telemetry, tracking and satellite communications. However, the 1959 Conference felt that, when space communications became a practical reality, a further conference should be convened and recommended that it should be held in the latter part of 1963. The ITU Administrative Council, at its 1962 session, formally proposed the convening of the conference and the proposal was accepted by a majority of ITU's member countries.

This conference will be mainly concerned with allocation of radio frequency bands for the requirements of space communications, now much more highly developed. The conference is also scheduled to consider the question of frequencies for radio-astronomy. A number of revisions will have to be made to the Radio Regulations, the basic ITU document governing the operation of radio throughout the world.

The conference has aroused considerable interest, not only in technical circles, but also in the United Nations. The General Assembly unanimously adopted a resolution on December 20, 1961, recommending that the ITU 'consider at this conference those aspects of space communication in which international cooperation will be required'. More recently, the Economic and Social Council has called the attention of all U.N. member countries 'to the importance of the action in which the International Telecommunication Union is engaged with reference to peaceful uses of outer space and, in particular, to the desirability of having all Member States participating in the forthcoming Extraordinary Administrative Radio Conference to allocate frequency bands for space radio communication purposes.

Symposium on 'Refrigeration in Developing Countries', Dacca, February 10-15, 1964

Under the auspices of the Pakistan Council for Scientific and Industrial Research (P.C.S.I.R.), the International Institute of Refrigeration of Paris, will hold a symposium on 'Refrigeration in Developing Countries', at Dacca, East Pakistan, from February 10-15, 1964. The theme for this symposium is 'Role of Refrigeration in Developing Countries'. The purpose of this symposium is to further the development of refrigeration applications in the tropical countries in South-East Asia and the Middle-East that are in the process of industrial and technical development. This symposium will be essentially devoted to refrigeration techniques and installations for the storage and transport of perishable foodstuffs. The main topics of the symposium are:

(i) Cold storage and transport of perishable foodstuffs (fruits and vegetables, meat, fish and dairy produce);
(ii) Construction and equipment of cold stores;
(iii) Insulating materials;
(iv) Refrigerants;
(v) Refrigerating plant and machinery specially adapted to applications in Asian countries plant service and repair; and
(vi) Solar energy.

Members who wish to contribute papers, consisting of a maximum of 2,000 words, based on any one of the above subjects, should send them to Mr. A. H. Chotani, Secretary, Pakistan Council for Scientific and Industrial Research, B. No. 50, Pakistan Secretariat, Karachi, Pakistan, and another copy to the Central Office of the International Institute of Refrigeration, 177 Boulevard Malesherbes, Paris 17^{E}.

International Conference on 'Transmission Aspects of Communication Networks', London, February 24-28, 1964

The Professional Group for Line and Radio Communication Systems of the Electronics Division of the Institution of Electrical Engineers, London, is arranging an International Conference on 'Transmission Aspects of Communications Networks' in London from February 24 to 28, 1964.

The scope of the conference will include the following topics: land and submarine cables; land distance and junction systems for use on open wire, cable and waveguides; transmission characteristics of links used as parts of main line networks; local networks; characteristics of subscribers plant; speech statics; multiplexing and modulation techniques for telephony, telegraphy, date and television; bandwidth conservation; filters and other networks.

Further details can be obtained from the Secretary, The Institution of Electrical Engineers, Savoy Place, London, W.C. 2.

International Conference and Exhibit on Aerospace Electro-Technology, Arizona, U.S.A., April 19-25, 1964

A conference on aerospace electrotechnology will be held in Phoenix, Arizona, U.S.A., from April 19-25, 1964. The conference is being sponsored by the Committees of the Aerospace Applications Subdivision and the Professional Technical Group on Aerospace of the Institute of Electrical and Electronic Engineers in collaboration with other technical societies. The conference will include panel discussions, technical papers and exhibits. Sessions on educational, management and training programmes are also planned.

Papers representing original contributions are invited in the following fields.

Electrical Systems: Manned spacecraft; Unmanned spacecraft; Light aircraft; Heavy aircraft; Mechanical and packaging design; Electromagnetic interference; Reliability; Electric propulsion; and Aerospace support.

Electronics Systems: Aerospace communications; Radar; Navigation; Command and control; Checkout equipment; Telemetry; Data processing; Integrated electronics; Reliability; and Antennas and propagation.

Energy Conversion: SNAP Systems; Solar cell systems; Thermoinics; Cryogenics; Rotating APU systems; Electromagnetic Generators; Magnetohydrodynamics; Fuel cells; Batteries; Power conditioning and superconductivity.

Thermoelectricity: Fundamental processes; Synthesis and evaluation of materials; methods of measurement; Design parameters; and Device construction and performance.

Those desirous of presenting papers should submit an abstract of not more than 250 words by August 19, 1963, and the finished manuscripts by November 1, 1963, to Arnold A. Sorensen, Technical Programme Chairman, Mail 3016, The Martin Co., Baltimore 3, Maryland, U.S.A., from whom further details can also be obtained.

BOOK ACKNOWLEDGMENT

1. **Road Engineering for L. C. E. Course.** J. Baksi. *New Central Book Agency, Calcutta,* Rs. 4. 105 pages.

This book is intended to serve as a text-book for the students of L.C.E. (Diploma Course). The subject is explained in eight chapters including a chapter on 'Culverts and Bridges'. Worked-out problems from L.C.E. question papers are given. In the concluding part, questions pertaining to each chapter are added.

2. **Text-Book of Experimental Electrical Engineering.** vol. 1. C. P. Desai. *Parimal Publishing House, Baroda,* Rs. 7.25. 207 pages.

This book covers the course of experiments on D.C. machines from the first to the final year degree and diploma courses of Indian universities. Each experiment is explained in detail. The chapterwise arranged questions together with the summary of formulæ make this book useful.

3. **Moment Distribution.** J. M. Gere. *D. Van Nostrand Co. Inc.,* 378 pages.

Basic concepts of moment distribution, the use of the method of superposition, and structures in which joint translation can occur are discussed in the first two chapters. Practical applications of the theory, including non-prismatic members; translational moment distribution; effect of shearing forces; flexible connections; effect of axial forces, and the determination of critical buckling loads of continuous beams and frames, have been explained in the subsequent chapters. A bibliography and appendices containing graphs of moment distribution factors for non-prismatic members are given at the end of the book.

4. **Engineering Heat Transfer.** S. T. Hsu. *D. Van Nostrand Co. Inc.,* $14.50. 613 pages.

This book provides a basic study of heat transfer closely tied to nuclear engineering. Information on thermal conductivity and viscosity of fluids is followed by elucidation of the theories of conduction and convection. Included in the book are: discussion of graphical methods and numerical analysis for solving problems, practical applications to both research and industry, discussion on the mechanism of radiation, and examination of some problems of re-entry. A chapter is devoted to conventional heat exchangers used in industry. The methods of measuring emissivity and conductivity, aerodynamics and space heat transfer, and electrical analogy have been dealt with. The final chapter on mass transfer describes the terminology and physical processes in heat exchangers. Illustrations, a list of references and a set of tables are included in this book which make it valuable to engineers and those concerned with research, design and operation in a number of related disciplines.

5. **Control of Hazards in Nuclear Reactors.** T. C. Sinclair. *Temple Press Books Ltd,* 15s. 84 pages.

This book explains the safety considerations in the design and operation of a nuclear power reactor from the viewpoints of radiation damage and hazards to personnel. The first chapter deals generally with the effects of radiation on man and sets out the limits placed upon personal exposure with particular regard to the operation of power factors. The second chapter gives the deleterious effects of radiation upon the integrity of reactor materials and the subsequent deterioration of their useful properties with regard to the graphite moderator as an example. The subsequent two chapters deal with the limits that must be placed upon the fuel, canning and pressure vessel materials so as to minimize the possibility of a dangerous release of radioactive material. The concluding chapter reviews the siting criteria for a nuclear power reactor in the light of possible harmful releases of radioactive materials and outlines the techniques for monitoring the surrounding area.

6. **Principles of Structural Metallurgy.** B. Harocopos. *Illiffe Books Ltd.*, 32s. 6d. 146 pages.

A brief survey of modern atomic theory and the theory of solidification is given at the beginning of the book. Standard procedures in metallographic practice are elaborated in a separate chapter. Subsequent chapters deal with metals and alloys most widely used in industry. These are considered in groups with a common basic metal at the head of each, and the equilibrium composition-temperature diagrams for each are presented together with an account of the structural modifications arising from non-equilibrium preparative conditions. Close connection between the structure and properties is aimed throughout, and a large number of applications are considered. Photomicrographs of structures of cast metals and alloys are also included in the book.

7. **Engineering Statistics.** A. H. Bowker and G. J. Lieberman. *Asia Publishing House*, Rs. 21.00. 585 pages.

The basic fundamentals of the probability and distribution theory are given at the beginning, followed by the theoretical aspects and practical applications of normal distribution, chi-square, *t*-, *F*-, binominal and Poisson distribution, significance tests, estimation, fitting of straight lines, analysis of variance, quality control and sampling inspection. Elucidation of the more difficult statistical concepts has been effected by making use of operational characteristic curves. In addition to the chapter on estimation, non-parametric techniques as well as one and two sample procedures are presented. Tables of factors for one-sided tolerances are included in this book.

OBITUARY

The sympathy of the Institution is extended to the relatives of those whose passing is recorded here.

Shri S. K. Dutta

Shri S. K. Dutta, B.Sc., B.E., C.E., M.R.S.H., M.I.E., died in Delhi in November 1962, at the age of 69.

Born in 1893, Shri Dutta obtained the B.E. degree of Calcutta University in 1915 and was engaged as student-engineer in the ex-Bengal-Nagpur Railway Co. from 1915 to 1916. He became Subdivisional Officer in 1926 and worked as Assistant Engineer from 1926 to 1940, and was subsequently promoted to the post of Executive Engineer in 1941. Among important works which he carried out during this period were the re-girdering of bridges on the Phulera-Kuchaman Road, Mehsana-Wadhwan section, the khodagunj bridge and the construction of a new loco yard at Mehsana.

Shri Dutta joined the Institution as Associate Member in 1925 and was transferred to Member in 1945.

Shri S. Sanyal

Shri Saileswar Sanyal, B.E., M.R.San.I., M.I.E., died in Calcutta in May 1963, at the age of 77.

Born in 1886 in Calcutta, he passed the B.E. examination of the Bombay University in 1914. He worked for S. C. Mukherjee & Sons for over 9 years. In 1925, he joined Sandell & Co. as Managing Proprietor, and in 1930 the Willas Construction Co. Ltd. as Director and Chief Engineer. During his professional career, Shri Sanyal was responsible for the construction of several jute mills and he designed and executed construction of Willas plants for disposal of sewage and industrial wstes.

Shri Sanyal joined the Institution as Member in 1935.

EMPLOYMENT SERVICE

This service is intended for the benefit of members of the Institution and for the Government, industrial and other organizations employing engineers. It is hoped that the employers will make full use of this service to obtain their requirement.

A small charge of Rs. 5 per insertion will be made to members for notices appearing in the 'Situations Wanted' column.

In the 'Situations Vacant' column a charge of Rs. 2 per line will be made.

Replies to advertisements should be addressed to Employment Service, The Institution of Engineers (India), P. O. Box No. 669, Calcutta 20, except where otherwise stated.

SITUATIONS VACANT

WANTED by an established engineering concern in Kanpur

(1) One GRADUATE MECHANICAL ENGINEER having at least 2 years actual experience in the installation of Diesel engines and water turbines up to 500 h.p.

(2) One GRADUATE IN ELECTRICAL ENGINEERING having at least 2 years actual experience in the installation of alternators and switchgear equipment up to 500 kW.

Selected candidates should be in a position to join duty within 6 weeks of appointment. After an initial period of training in Kanpur for 2/3 months, further training in the makers works in Germany will be given at the firm's expense. Selected candidates will have to enter into an agreement to serve the company for a period of not less than 5 years and will have to give the names of two individuals of position or means who shall act as guarantors.

Starting salary will be Rs. 300/400 per month consolidated, depending on qualifications and experience and after training Rs. 400/500 per month consolidated with suitable increment.

Applications with full particulars of qualification, practical experience, details of previous employment, supported by certificates with a passport size photograph should be sent to Post Box 139, Kanpur, before September 30, 1963. Incomplete applications will not be considered.

ASSAM OIL COMPANY LTD., DIGBOI P.O., ASSAM

Vacancies for Engineers

Applications are invited for the following posts.

ONE CIVIL ENGINEER

Graduate or equivalent with not less than 7 years experience on building and maintenance of residentual and industrial buildings and estates of various types, roads, drainage systems, small bridges and culverts, machinery and plant foundations, earthwork, also experience in dealing with contracts and contractors, draughting/estimating/fixing rates for contracts, measurements and bill calculations. Sound practical background and proof of work actually accomplished are required in addition to a technical qualification.

JUNIOR MECHANICAL ENGINEERS

Graduates/Diploma holders equivalent with at least 4 years experience on any of the following posts: Erection/Maintenance/Operation of Process Plant, boilers and auxiliaries, refrigeration plant, tanks, pumps, pipelines, heavy I.C. engines, steam engines, turbines, press tools/work, drawing office and estimating, general workshops. Sound practical experience/training and adaptability are required in addition to a technical qualification.

Method of application and further information

An application form and information regarding terms/conditions of service may be obtained from the Staff Manager at the above address on receipt of a stamped addressed envelope of 9½ in.×4½ in. size. Letters/envelopes/forms must all be clearly endorsed 'CIVIL ENGINEER' or 'JUNIOR MECHANICAL ENGINEER' as the case may be. No other correspondence will be dealt with at this stage. Only engineers fulfilling the above requirements should apply; others will not be considered.

SITUATIONS WANTED

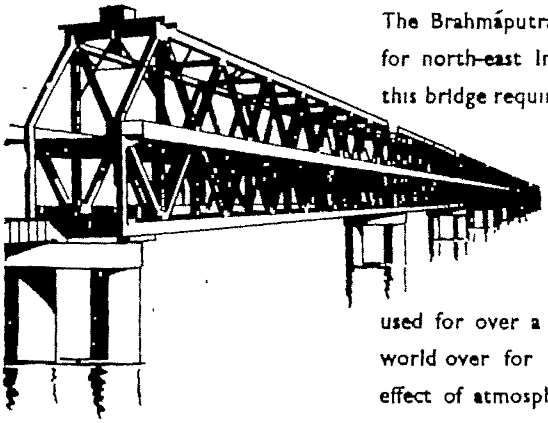
YOUNG ELECTRICAL ENGINEER, B.Sc., passed Sections A and B of the Associate Membership Examination of the Institution of Engineers (India), First Class Boiler Engineer from West Bengal Board of Examiners, having nearly 9 years experience in erection, operation and maintenance of various types of thermal power plant consisting of high pressure boilers, turbines, L.T. and H.T. switchgear, etc. and various ancillary plant; operation and maintenance of cement manufacturing machinery, both electrical and mechanical; production control; water treatment; administration of labour (about 250); age 27 years; present emoluments of about Rs. 750 per month; seeks suitable change as Electrical Engineer, Power Station Superintendent or Power Station Maintenance Engineer. (Office ref. 131)

YOUNG ENGINEER, age about 37, holding first class Diploma in Mechanical and Electrical Engineering from a Government Technical Institute, Certificate of Competency as first class engineer under Indian Boiler Act and specialist in air-conditioning and refrigeration engineering from the University of Roorkee; having 15 years experience; holding a gazetted, permanent, pensionable and non-transferable post in the scale of Rs. 350-900, seeks better employment in the scale of Rs. 700-1,250 or nearabout, preferably in a chemical factory. (Office ref. E.S. 132)

A B.Sc. of Calcutta University, passed Sections A and B of the Associate Membership examination of the Institution of Engineers (India) with 'Electrical Machinery' and, Electrical Measurement and Measuring Instruments' as optional subjects; five years experience in the laboratory of the electrical engineering department of an engineering college with post-graduate facilities in the installation, maintenance and testing of electrical equipments such as D.C. generator, D.C. motor, single and three-phase alternators, converters, different types of relays, switchgears, etc., and demonstration of these to students; seeks a suitable position in power generation or production lines immediately. (Office ref. E.S. 133)

MECHANICAL ENGINEERING GRADUATE, A.M.I.E., age 31 years, having over seven years experience in factory maintenance and tea garden labour management with a British firm in covenanted grade, seeks change. (Office ref. E.S. 134)

PROVED PROTECTION
FOR A NEW BRIDGE.



The Brahmaputra bridge ushers in a new era of progress for north-east India. Built at a cost of Rs. 10 6 crores, this bridge required approximately 10,000 tons of steel. It is not surprising that all the steel fabrication of this bridge has been primed with RED LEAD to protect it from rust and corrosion. A proved priming paint, RED LEAD has been used for over a century on iron and steel structures the world over for the highest resistance to the corrosive effect of atmospheric conditions.

D. WALDIE & CO.
(LEAD OXIDES) LTD.

Secretaries & Treasurers :
GILLANDERS ARBUTHNOT & CO. LTD.,
Gillander House, Netaji Subhas Road, Calcutta-1

DWC-8

ATTENTION

CIVIL ENGINEERING CONTRACTORS WITH
EXPERIENCE IN MARITIME WORKS

Development Works at the Port of Bombay-India

The Trustees of the Port of Bombay intend to undertake the following major development works at their port :—

(i) Extension of the Alexandra Dock involving construction of 827 metres of quay wall and reclamation of 6.5 hectares within a bund ;
(ii) Construction of a piled reinforced concrete jetty, 175m × 40m with an approach 150m × 18m for ferry traffic ;
(iii) Extension of Ballard Pier 230m × 100m to provide a deep water quay in block work placed under water ;
(iv) Construction of a new passenger terminal-cum-transit shed; 260m & 42m and car park on piled foundation

and

(v) Associated dredging in hard and soft material and other ancillary works.

For the execution of these works, the Trustees propose to invite tenders from selected contractors on a global basis. Interested contractors with adequate experience in maritime works who wish to be considered for such selection, are accordingly requested to apply, in writing, before 30th September, 1963 to Messrs. Bertlin & Wilton & Bell, Consulting Engineers, Bombay Port Trust, 4 Abbey House, Victoria Street, Westminster, London, S.W.1., for further details of the works to be constructed and a questionnaire to be completed by the intending tenderers.

THE INSTITUTION, ITS LOCAL CENTRES AND SUB-CENTRES

Headquarters

8 Gokhale Road, Calcutta 20
P.O. Box No. 669
Telephone 47-4344 (2 lines) Telegrams ENJOIND

Local Centres

Andhra Pradesh	Khairatabad, Hyderabad-Dn. (*Telephone 33066*).
Assam	P.W.D. Secretariat (R & B), Shillong (*Telephone 47-2744*).
Bengal	8 Gokhale Road, Calcutta 20 (*Telephone 47-2744*).
Bihar	Huda House, Gandhi Maidan Road, Patna 1 (*Telephone 2639*).
Bombay	Ilaco House, Sir Pherozeshah Mehta Road, Fort, Bombay (*Telephone 26-3430*).
Delhi	Mathura Road, near Hardinge Bridge, New Delhi (*Telephone 42702*).
Gujarat	C/o Gujarat Institute of Civil Engineers and Architects Building, Law College Road, Ahmedabad 6.
Jammu & Kashmir	C/o Superintending Engineer, Flood Control Circle, Srinagar.
Kerala	12/23B Observatory Hill, Trivandrum (*Telephone 2663*).
Madhya Pradesh	C/o Government Engineering College, Jabalpur.
Madras	Adam's Road, Chepauk, P.O. Triplicane, Madras 5 (*Telephone 85879*).
Mysore	Mysore Engineers' Association Building, Bangalore (*Telephone 5471*).
Nagpur	North Ambazari Road, Nagpur 1 (*Telephone 5671*).
Orissa	3A Cantonment, Cuttack 1.
Poona	Saraswati Sadan, 1287 Shivajinagar, Rani Laxmi Chowk, Poona 5 (*Telephone 7377*).
Punjab	Thapar Institute of Engineering and Technology Building, Patiala.
Rajasthan	C 46, C-Scheme, Jaipur (*Telephone 3327*).
Uttar Pradesh	River Bank Colony, Lucknow (*Telephone 5325*).

Sub-Centres

Baroda	C/o Faculty of Technology and Engineering, Maharaja Sayajirao University of Baroda, Kala Bhavan, Baroda (*Telephone 2529*).
Bhilai	Welfare Building 2, Bhilai Steel Works, Bhilai
Bhopal	C/o Shri D. Dhar, Transformer Engineering Department Heavy Electricals (India) Ltd., Bhopal.
Dhanbad	C/o Shri B. H. Engineer, Coal Adviser, Tata's Jamadova Colliery, P.O. Jealgora, Dhanbad.
Durgapur	C/o Chief Electrical Engineer, Durgapur Steel Project, Durgapur.
Jammu	C/o Office of the Superintending Engineer, Electric Project and Planning Circle, Jammu.
Jamshedpur	C/o Technical Institute, N Road, Jamshedpur.
Kharagpur	C/o Department of Civil Engineering, Indian Institute of Technology, Kharagpur.
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